APPENDIX I: IMPACTS OF WINTER RECREATION ON WILDLIFE IN YELLOWSTONE NATIONAL PARK: A LITERATURE REVIEW AND RECOMMENDATIONS

by

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Report requested by the Branches of Planning and Compliance, Natural Resources, and Resources Management and Visitor Protection, Yellowstone National Park, Wyoming.

About the Author:

Dr. Caslick was a summer seasonal ranger in Yellowstone for three summers, starting in 1951. He was a wildlife biologist and directed a wildlife research laboratory for the U.S. Fish and Wildlife Service for 13 years. His graduate degrees are from Cornell University, where he taught wildlife research and management techniques for 18 years. Since retiring from Cornell, he and Mrs. Caslick have been full-time volunteers in Yellowstone for the past eight winters.

Table of Contents

Foreword

Numerous studies have concluded that wildlife is a major component of the Yellowstone experience, and a major economic "draw" to the area.

As increasing pressures for development of visitor facilities and new modes of transportation evolve, early consideration of their potential effects on wildlife (including individual animals, animal populations, and associated ecological processes) become ever more important, if wildlife resources are to continue to be a major feature of Yellowstone.

The purpose of this report is to briefly summarize and evaluate the published research on winter-recreation impacts on wildlife, particularly as they apply to Yellowstone, and to provide recommendations. This may have immediate application in decision-making during the trade-off processes that inevitably must occur when balancing resource conservation with visitor enjoyment.

Procedure

Starting in November 1996, I used "A Review of Potential Effects of Winter Recreation on Wildlife in Grand Teton and Yellowstone National Parks: A Bibliographic Data Base" by L. E. Bennett, 1995, as a starting point for the literature review. We obtained the electronic bibliographic component assembled with the ProCite bibliographic software program. I read the 139-page hard copy including the 465-entry bibliography, and deleted from our consideration 200 entries such as field guides that appeared to have little or no particular relevance to Yellowstone.

Using this shortened bibliography, I read as many of the relevant publications as could be located in Yellowstone and made reprint requests to authors and publishers. I also searched the new ProCite Natural History Database in the Yellowstone Research Library, and other bibliographies on the topic kindly provided by others. The Montana State University Library had previously been searched by K. Legg of the Office of Planning and Compliance, YNP, who advised that a repeat of that search probably would not be productive.

During my literature research, 211 new literature citations were discovered that seemed to have potential relevance to Yellowstone. Many of the most pertinent new literature sources that I found were in the M.S. and Ph.D. theses in the Yellowstone Research Library. All of these 211 new literature citations were listed in "New Citations on Winter Recreation Effects on Wildlife, J. and E. Caslick, 1997, 22 pp.," a copy of which is attached as Appendix 1. These new citations were then integrated with our revised list of Bennett (1995) to form "Selected Literature Citations from Bennett 1995 and New Citations from Caslick 1997 on Winter Recreation Effects on Wildlife, J. and E. Caslick, 1997, 74 pp.," a copy of which is attached as Appendix II. The new citations were also added to the revised ProCite database, now on file at YCR.

I met with the Visitor Use Management (VUM) Planning Team's Wildlife Resource Impacts Work Group on December 17/96, January 31, and February 24/97, sought their suggestions, and provided members with copies of 10 pertinent articles, as well as a draft of the new citations listing.

During the literature review and excerpting process, I attempted to retain the authors' interpretations by excerpting quotations; much can be lost otherwise. A summary of these findings in the literature was prepared as a matrix entitled "Matrix of Winter Recreation Effects on Wildlife, J. and E. Caslick, 1997, 25 pp.," a copy of which is attached as Appendix III. Rather than presenting a matrix chart with numbers that refer to a separate bibliography, it seemed much more immediately useful to excerpt the most pertinent information in the matrix and show the authors/dates, thus allowing the user a choice of searching out the complete article, or using my excerpt without having to chase out the reference.

I found no documented impacts to mid-size carnivores. Although Yellowstone is believed to help support a viable population of wolverines, and lynx may have been resident over time, there is less evidence of historic or present fisher populations (Anon., National Park Service 1995:78). However, concern about the possibility of denning disturbance of wolverines by winter recreationists in high-altitude cirques was discussed by biologists at a VUM meeting in Bozeman this winter. Visitor impacts on coyotes have not been located in the literature, although in Yellowstone coyotes have long been observed to frequent plowed roads, snowmobile trails, ski trails, and other human trails, sometimes have been illegally fed, and apparently some coyotes have learned that they may be fed by humans. No research on this topic is listed in the 1995 YCR Investigators' Annual Report, although this continues to be a management concern. In an ongoing study of the effects of the l988 fires on coyotes, adult mortality was found to be "very low and primarily due to vehicles and mountain lions." Nine coyotes were reported killed by vehicles in the park in 1995 (Anon., National Park Service 1995). Although about 20 adult mountain lions inhabit Yellowstone's northern range, no impacts by recreationists other than by hunters outside the park have been documented (pers. comm. K. Murphy, Feb. 1997).

I have not included effects on vegetation or soils in this report, because most winter recreationists in Yellowstone use established trails or roadways, with snowcover present.

Time and the obscurity of some references precluded my review of all articles whose titles appeared to have some relevance to Yellowstone. I've included some of these in the matrix that may well be worthwhile to obtain and review.

In general, I feel fairly comfortable about the extent of my review of this topic. More could be done, of course, and review of new literature on the topic should be ongoing, particularly the emerging bodies of literature on wildlife energetics and nutrition in winter, stresses induced by human activities (including roads), the importance of habitat corridors, stressed ecosystems, and the developing science of ecotourism.

Summary of Literature Review

Much of the literature on this topic dates from the 1970s, when snowmobiles were new on the winter scene. There was a flurry of related papers, particularly from the Midwestern states, where several snowmobile conferences were held at universities. Many of the publications appeared in conference proceedings, not in refereed journals, so many literature citations are anecdotal accounts rather than reports of well-designed research projects that have tested hypotheses and used “controls.” Reports sometimes conflicted with previous findings, but there was general agreement that winter recreation, particularly snowmobiling, had great potential for negatively impacting wildlife and wildlife habitats (particularly vegetation). Even in these early conferences, snowmobile manufacturers were urged by wildlife biologists, at least, to design machines that were quieter and less-polluting. Snowmobile-polluted snow and its effects on wildlife, fish, and other aquatic organisms have not been investigated in Yellowstone, although published accounts elsewhere began at least 24 years ago (see 8 literature citations on “Polluted Snow” in this report). This seems to be another topic that should have been researched here long ago, particularly since we probably experience a higher intensity of snowmobile use than anywhere else, and since our fish and wildlife resources are so highly concentrated and of such unique public value.

During the late 1970s and early 1980s, most of the publications on human impacts on wildlife dealt with impacts on nesting birds. Perhaps this is because such impacts are more readily evident and easier to quantify for birds than for mammals. Among birds, nesting shorebirds and waterfowl in refuges and parks were then the dominant topics. Later in the 1980s, literature began to be dominated by visitor effects on nesting bald eagles. Effects on ungulates began to be published as state game departments and the U.S. Forest Service became concerned. In 1985, Boyle and Samson published a benchmark bibliography of 536 references that identified 166 articles containing original data, and “reported that mechanized forms of recreation had the greatest impacts on wildlife, causing habitat disturbance, disrupting of animal behavior, noise pollution, and even direct mortality.” (Purdy et al. 1987:6). The pace of publication slowed as some organizations imposed visitor-use restrictions, in a preventative mode, perhaps recognizing the difficulty and expense of definitive research. This is largely the situation today, although there is a slight increase of interest (largely academic) in quantifying nutritional and energetic stresses as they relate to ungulates and endangered species. The most recent publications of note deal with these latter topics, and with techniques for classifying, evaluating, and mitigating visitor use impacts.

By far, the most comprehensive single reference on this topic is a new book by several specialists in this field, “Wildlife and Recreationists: Coexistence Through Management and Research,” by R.L. Knight and K.J. Gutzwiller, eds. (1995), Island Press, Washington, D.C., 372 pp. During this project, I contacted the publisher for copyright permission and provided copies of pertinent chapters to members of the VUM Planning Team’s Wildlife Resource Impacts Work Group. Twenty chapters with different authors address such topics as Factors that Influence Wildlife Responses to Recreationists, Physiological Responses of Wildlife to Disturbance, Recreational

Disturbance and Wildlife Populations, and Indirect Effects of Recreationists on Wildlife. I highly recommend this book to anyone interested the current state of this topic.

The published concern about direct and indirect effects of winter recreationists on wildlife has not diminished among wildlife researchers elsewhere. From the early and obvious effects of intentional snowmobile harassment on wintering concentrations of wildlife, particularly in the Midwestern and eastern U.S., interest soon (although slowly) turned to unintended effects of winter recreation on wildlife. As early as 1975, Severinghaus and Tullar of the New York State Conservation Department were using energy expenditure calculations to demonstrate that deer already pressed by winter conditions should not be further stressed by snowmobiles, and recommended that snowmobile trails should be at least 1/2 mile from winter concentrations of white-tailed deer. Winter harassment of deer by snowmobiles was reported as detrimental to their winter adaptations for energy conservation in New York and Minnesota (Moen 1976, 1978), and winter energetics considerations and calculations for ungulates have continued as highly important research topics reported in peer-reviewed journals and are continuing today. Some of this energetics research has very recently been conducted by others in Yellowstone (see DelGuidice et al. 1994, 1991, for bison and elk), and could be tied to research on the energy expenditures required for locomotion by ungulates (see Parker et al. 1984, for mule deer and elk), to result in meaningful implications for recreation impacts on wintering wildlife in Yellowstone. In fact, Parker et al. (1984) discussed management implications based on energy-costs of locomotion for mule deer and elk, when disturbed by winter recreationists, and they pointed out that “the additional energy drain on a wintering population on poor range may be an important factor in survival” (p. 486). I consider winter-energetics research to be the most meaningful direction for “pure” research to further clarify the extent to which winter recreationists are negatively affecting winter-stressed wildlife in Yellowstone. (See Recommendations for Research #2, below).

Documented Impacts

In Yellowstone

As early as 1981, effects of winter recreationists on the physical environment of Yellowstone were reported to include air and snow pollution by snowmobile exhaust, litter, noise pollution, and limited damage to soils and plants in portions of the Madison, Firehole, and Gibbon river valleys (Aune 1981).

My review of the literature leaves me with no doubt that winter recreation activities in Yellowstone have affected wildlife behavior and survival, including bison use of groomed snowmobile trails (Aune 1981), and groomed-trail effects on changes in bison movements, habitat use, distribution and calf survival (Meagher 1993); Yellowstone elk have been affected by cross-country skiers (Aune 1981; Cassirer et al. 1992), and in Yellowstone, snowmobiling or cross-country skiers have caused most trumpeter swans to fly (Shea 1979).

Elsewhere in Montana and Wyoming

Elsewhere in Montana and Wyoming, published literature documents that snowmobile use has impacted deer, elk and small mammals (Aasheim 1980), bald eagles (Shea 1975; Alt 1980; Harmata 1996), an avian scavenger guild including bald eagles and black-billed magpies (Skagen et al. 1991), elk (Aasheim 1980) and bighorn sheep (Berwick 1968). There is no apparent reason to expect that similar effects would not occur in Yellowstone, where winter conditions are generally more severe and the intensity of snowmobile usage is generally higher than elsewhere in Montana and Wyoming.

Recommendations for Management

Winter Weather Considerations

Winters in Yellowstone are generally more severe than in any of the areas where recreational impacts on wildlife have been studied. This imposes an immediate constraint on applying the results of research conducted elsewhere; Yellowstone winters likely impose greater stresses on wildlife, even before visitor-induced stresses are added. For example, snowmobile activity in the Midwestern states has been shown to result in white-tailed deer movements away from trails. The energy cost of such movement at Midwestern snowdepths and temperatures are likely to be much less than for a similar movement under Yellowstone winter conditions. This movement must also be considered in the contexts of energy replacement costs and the quality of the habitat to which deer must move—must they now move more than previously to meet their energy requirements?

Proximity to and Overlap of Road Systems, Critical Winter Habitats (thermally-influenced) and Recreation Activities (road, trails, developments).

In Yellowstone, as elsewhere, there is a general shift of wildlife to lower-elevation habitats during winter. These habitats often are the riparian habitats in which the road system has been constructed. Since snowmobiling in Yellowstone is presently restricted to these established roadways, there is an immediate conflict in land uses. We have built our roads and developed areas in important (and perhaps key) wildlife wintering habitats, thereby reducing wildlife carrying capacity of the park. Winter uses and groomed roads are new environmental factors in these traditional wintering grounds, and we have yet to learn if and how some wildlife species, guilds, or populations will be affected in the long term. Some immediate effects are apparent, including displacement of individual animals and small groups, and associated energy expenditures by wildlife that result from recreationist activities and the related support and maintenance activities of the park and park concessioners.

There can be little doubt that continued human activity and additional commercial developments in these riparian areas will continue to degrade and diminish winter wildlife habitats, through depletion of resources previously available to wintering wildlife. This has been the pattern of wildlife population declines world-wide; there is no rationale for expecting results to be different here. Yellowstone now has wildlife in relative abundance because of a relatively low rate of human exploitation of habitats, but the clock is ticking and the exploitation rate is rapidly increasing.

The challenge for park managers is to apply the brakes now to slow the exploitation rate. Enforcement of park regulations alone will likely not suffice. Managers must make aggressive use of new techniques that promise to assist resource conservation efforts while concurrently accommodating visitor use. The science of ecotourism shows promise in this regard and park managers should explore its literature, learn how its principles are being applied in park management elsewhere (Anderson 1993; Blangley & Wood 1993; deGroot 1983; Wallace 1993), and stay tuned for further developments. The management emphasis here must be on conservation, education, then visitor use, in that order of priority, if the wildlife values of this park are to be retained in the long-term.

1. Reduce Snowmobiling Impacts in Thermally-Influenced Habitats

In regard to wildlife in Yellowstone, I conclude from my literature review that the most pressing VUM issue is snowmobiling—not snowmobiling in general, but snowmobiling in and near thermally-affected wildlife habitats that are known to be unique and of critical value to wildlife in winter. This value to Yellowstone wildlife is not conjecture; it has been widely recognized and published about for many years, particularly in regard to elk (USDI/NPS 1990), bison (Meagher 1970), bald eagles (Alt 1980; Swenson 1986, USDI/NPS 1990, 1995), and trumpeter swans (Shea 1979; USDI/NPS 1990). The <u>Matrix of Winter Recreation Effects on Wildlife</u> and <u>Selected Literature Citations. . .</u> attached as Appendices III and II support this view. From my literature review, I conclude that there is now ample documentation to administratively close these thermally-influenced winter habitats, prohibiting winter use by private and commercial snowmachines, skiers, snowshoers, and hikers.

To increase protection of these thermally-influenced wildlife habitats in winter and to interrupt the existing network of groomed trails now known to be used by Yellowstone elk and moose (USDI/NPS 1990) and bison (Aune 1981; Meagher 1993), I therefore recommend that private and commercial snowmachine use be permitted in the park only as follows:

(1) Mammoth to Indian Creek Campground
(2) West Entrance to 7-mile Bridge
(3) South Entrance to Lewis Lake Campground
(4) East Entrance to Sylvan Lake (or Sylvan Pass).

To further reduce impacts on wildlife, over-snow administrative travel on other park roads should be restricted to the middle hours of daylight (*i.e.*, 10 a.m. to 4 p.m.) to avoid wildlife disturbance during their early morning and evening feeding periods.

During winter, processes that influence energy intake, rather than energy expenditure, have a much greater influence on the energy balances of ungulates (Hobbs 1989).

2. Discontinue the “Harmful vs. Beneficial” Dichotomy.

I recommend that VUM planners and managers in Yellowstone discontinue speculation about whether particular impacts are harmful or beneficial to wildlife. Where management’s objective is to maintain natural processes and minimize the effects of humans, such value judgments are inappropriate and unproductive. Rather, the appropriate challenges seem to be detection of impacts, quantification thereof, timely decisions on priorities for mitigation activities, and implementation of those activities.

3. Initiate Visitor Use Management Trials and Monitor the Results.

From years of experience in wildlife research and management, I am aware of the tendency to call for more research and thereby postpone important decisions until research results are available. Certainly more research on the topic of this report would be useful, and recommendations for research are given in a later section of this report. But there is a recent development in methodology for tackling complex management issues that does not seem to be in use in Yellowstone. This is the approach called for by Dr. N. Christensen when he delivered the Leopold Lecture at Yellowstone’s First Biennial Scientific Conference in 1991. He said, “ignorance will not provide a reprieve from managing” and that through viewing management plans as “<u>working hypotheses that can be tested over time</u>,” the challenges can be overcome (Anon. 1992) (emphasis added). This idea had been previously suggested by MacNab (1983) and most recently by Knight and Gutzwiller (1995), who suggested that serial management experiments can be used to assess cause and effect relationships - such as visitor use impacts - using temporal and spatial controls, randomized designs, covariates, and adequate replication. Note that these are management experiments not intended to replace long-term research, but to initiate action programs that may be helpful, while awaiting research results.

In Yellowstone, we don’t need to <u>prove</u> that specific human activities are impacting wildlife before we initiate management measures. Where there are <u>indications</u> that impacts <u>may</u> be occurring, managers could undertake experimental management measures to reduce/minimize/eliminate these effects, while carefully documenting the results of the experimental management program. This documentation would provide a basis for making decisions about visitor use management needs and possibly elucidate priorities for research.

4. Adopt Standardized Terminology for Classification of Impacts and Impact-Mitigation Techniques.

Visitor use management in Yellowstone should be based on the recognition that there is no such thing as the non-consumptive use of wildlife or other natural resources. Every use exacts a toll. This has been a published view for at least 20 years (Wilkes 1977; Weedin 1981).

VUM then becomes a series of decisions about:

(1) what is the toll?
(2) is the toll acceptable?
(3) if not, how can the toll be reduced?

To classify impacts on wildlife, I recommend the scheme developed by Purdy et al. (1987) for the National Wildlife Refuges; these impacts are:

Direct Mortality
Indirect Mortality
Lowered Productivity
Reduced Use of Refuge (Park for YNP)
Reduced Use of Preferred Habitat
Aberrant Behavior/Stress

The classifications could as well serve as standards for evaluating visitor impacts on wildlife, and as standards evaluating the effectiveness of VUM measures in Yellowstone. The suggested measures of controlling visitor-related impacts on refuges (Visitor Education, Zoning, Restrictions on Activities, Law Enforcement, and various combinations of these measures) are all applicable here and could as well serve as a classification scheme for YNP mitigation efforts.

5. Consider Non-Visitor Impacts

The VUM plan should address impacts to wildlife that result from tour groups, scientists, educational activities (NPS, Yellowstone Institute, school groups, concessioner activities and NPS administrative activities) (see White and Bratton 1980). Mitigation techniques - initially evaluated as management trials - might include both temporal and spatial components. For example, during the period between official close of the park for the winter season and opening for the summer season, the park could restrict administrative travel on the previously groomed snowmobile routes to that required for official emergency travel only. Whenever possible, restrict even this emergency use to the mid-daylight hours (*i.e.*, 10 a.m. to 4 p.m.) to avoid disruption of the major feeding times for wildlife, during these critical weeks in wildlife survival.

6. Consider Sacrifice Areas

In defining VUM Potential Opportunity Areas, there seems to be an underlying assumption that it is desirable to distribute recreation throughout the greater Yellowstone area (p. 1, para. 3, Feb. 1996 draft). I recommend that this basic assumption be reconsidered to include the possibility that small sacrifice areas and large administrative closures may be ecologically preferable. For example, in Yellowstone, it may be preferable to dedicate a small area of low-quality wildlife habitat to heavy-use snowmobiling if, in so doing, a large thermal area of high-quality wildlife habitat is thereby protected.

7. Convene a Panel of Outside Specialists

Convene a panel of outside specialists on winter recreation effects on wildlife, specialists on human dimensions in wildlife management, and specialists in conflict resolution in resource management, to address the topic "Management of Winter Recreation Impacts on Wildlife in Yellowstone." Provide participants with copies of this report and other pertinent information, including NPS policy, prior to the meeting. Charge them with making recommendations for both immediate and long-term visitor management, and related short-term and long-term research projects and priorities. I can provide names of some potential participants. I recognize that suggestion of a panel of outside experts may strike fear in the hearts of some administrators, but recommendations may be accepted or rejected, and traditional public hearings in gateway communities cannot be expected to provide expertise or consensus. In fact, Dr. Kellert of Yale University, a specialist in public attitudes and the human dimensions of resource management, has published his view that public hearings are confrontational procedures that tend to harden positions and foster polarization. Like lake trout control, visitor use management here is a complex issue requiring input from specialists.

8. Prepare an EIS

Based upon the published effects of winter recreation on wildlife in Yellowstone that are documented here, and possibly including other air and water quality concerns in Yellowstone, promptly initiate preparation of an Environmental Impact Statement (EIS) on Winter Visitor Use in Yellowstone. In the EIS, include alternatives of "no snowmobiling" as well as alternatives for additional spatial and temporal restrictions on over-snow travel, as outlined above. Include consideration of alternative modes of transport for winter visitor enjoyment of park resources. Suspend further improvement and development of facilities to accommodate winter visitors (including Old Faithful Snowlodge), pending outcome of the NEPA process.

Recommendations for Research

The World Heritage Committee, an international panel of conservationists from countries that signed the World Heritage Convention in 1973, met in Yellowstone in 1995 and voted to add Yellowstone to a list of "endangered" sites that are "of universal value to mankind." The growing number of park visitors was one of the factors upon which this decision was based (Anon. 1996: 10).

Although Yellowstone has a Winter Use Resource Team, as of 1995 the team apparently had not decided whether increasing winter use was harmful to wildlife: "Increasing winter use may be harmful for wildlife . . ." (Anon. 1996:18) (emphasis added). Information gathered by the team in 1995 included a winter recreation and wildlife literature search by the University of Wyoming for Grand Teton National Park (Bennett 1995).

Winter visitor impacts were not a major area of emphasis reported in the Natural Resources Programs section of the Yellowstone Center for Resources 1995 Annual Report (Anon. 1996a). Although the 1990 Winter Use Plan Environmental Assessment for Yellowstone NP/Grand Teton NP/Rockefeller Parkway identified the need for more research on wildlife to determine "if visitor is causing impacts to wildlife" (USDI 1990:40) (emphasis added), Yellowstone's 1995 Investigators' Annual Report shows that no such studies have been initiated or currently are underway; the only projects listed as "visitor impacts" studies are a study of backcountry campsite use on conifer forest structure (Montana State University) and a study of human collection of artifacts scattered in a campground (University of Nebraska) (Anon. 1996b). There are no studies of visitor impacts on wildlife.

1. Actively Seek Outside Funding

It seems incredulous that so little research or management attention has been given or is now being given to this topic in this park. I therefore recommend that Yellowstone become pro-active in seeking outside funding from NSF and private sources such as the Rockefeller Foundation to support a well-planned research program that is coordinated with management efforts, and aimed at further clarifying visitor use/wildlife welfare relationships in this park. Invite park critics and others interested in this topic to financially support this new effort through the usual legislative processes and through direct contributions earmarked for this purpose.

2. Invite Research Proposals on Specific Topics

Invite research proposals from universities and others and prioritize funding to support those projects that address the most immediate needs of park management. Give highest priority to short-term projects that evaluate visitor use management strategies and to long-term projects that emphasize winter nutrition and energy budgets of wildlife, stress effects, survival strategies, and the modeling of these factors for population viability analyses. Focus on critical periods, critical habitats, synergistic effects and cumulative effects for wildlife present in Yellowstone, in winter.

Related studies such as that of Henry (1980), who examined relationships between visitor use and capacity for Kenya’s Amboseli National Park, as a Ph.D. thesis, should also be encouraged and supported.

Thank you for the opportunity to review and summarize this literature, prepare this report, and make recommendations that I hope will be useful. I have appreciated the interest and support of the Yellowstone staff during completion of this project.

Attachments: 3

Appendix I

NEW CITATIONS ON WINTER RECREATION EFFECTS ON WILDLIFE

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March 1997

These are literature citations that were not included in Bennett, L.E. 1995. A review of potential effects of winter recreation on wildlife in Grand Teton and Yellowstone National Parks: a bibliographic data base. Univ. of Wyo. Coop. Fish & Wildlife Research Unit, Laramie. 108 pp.

1. Alt, K. L. ECOLOGY OF THE BREEDING BALD EAGLE AND OSPREY IN THE GRAND TETON-YELLOWSTONE NATIONAL PARKS COMPLEX. M. S. thesis. Univ. of Montana. 95 pp. 1980.
Note: new.

2. Anderson, D. L. A WINDOW TO THE NATURAL WORLD: THE DESIGN OF ECOTOURISM FACILITIES. In Ecotourism: A Guide for Planners and Managers, eds. K. Lindberg and D. E. Hawkins, 116-153. North Bennington, Vermont: The Ecotourism Society. 1993.
Note: new.
Emphasis on design to reduce environmental impacts and enhance visitors' satisfaction and awareness of the environment.

3. Anderson, S. H. RECREATIONAL DISTURBANCE AND WILDLIFE POPULATIONS. In R. L. Knight and K. J. Gutzwiller, eds. Wildlife and Recreation: Coexistence Through Management and Research. Island Press. Washington, D.C. 1995.
Note: new.

4. Anthony, A. and E. Ackerman. EFFECTS OF NOISE ON THE BLOOD EOSINOPHIL LEVELS AND ADRENALS OF MICE. Journal of the Acoustical Society of America 27(6):1144-1149. 1955.
Note: new.

5. Anthony, R. G., R. J. Steidl, and K. McGarigal. RECREATION AND BALD EAGLES IN THE PACIFIC NORTHWEST. In: Wildlife and Recreation: Coexistence Through Management and Research, R. L. Knight and K. J. Gutzwiller, eds., pp. 223-241. Island Press. Washington, D.C. 1995.
Note: new.
Human disturbance is most serious for eagles that depend on large fish or mammal carcasses as their major food source.

6. Baldwin, F. M. THE OFF-ROAD VEHICLE AND ENVIRONMENTAL QUALITY; A REPORT ON THE SOCIAL AND ENVIRONMENTAL EFFECTS OF OFF-ROAD VEHICLES, PARTICULARLY SNOWMOBILES, WITH SUGGESTED POLICIES FOR THEIR CONTROL. The Conservation Foundation, Washington, D.C. 52 pp. 1970.
Note: new.
Clearly the effective way to protect fish and wildlife is not by restricting hunting or harassment alone, but by banning these vehicles from important habitats (p.25).

7. Baldwin, M. F. and D. H. Stoddard, Jr. THE OFF-ROAD VEHICLE AND ENVIRONMENTAL QUALITY: AN UPDATED REPORT ON THE SOCIAL AND ENVIRONMENTAL EFFECTS OF OFF-ROAD VEHICLES, PARTICULARLY SNOWMOBILES, WITH SUGGESTED POLICIES FOR THEIR CONTROL. 2nd ed. Conservation Foundation. Washington, D.C. 61 pp. 1973.
Note: new.

8. Bayfield, N. G. SOME EFFECTS OF WALKING AND SKIING ON VEGETATION AT CAIRNGORM. J. Applied Ecology 7:469-485. 1970.
Note: new.

9. Beier, P. DETERMINING MINIMUM HABITAT AREAS AND HABITAT CORRIDORS FOR COUGARS. Conser. Biol. 7:94-108. 1993.
Note: new.

10. Bennett, L. E. A REVIEW OF POTENTIAL EFFECTS OF WINTER RECREATION ON WILDLIFE IN GRAND TETON AND YELLOWSTONE NATIONAL PARKS: A BIBLIOGRAPHIC DATABASE. Final Report. Mimeo. Sponsored by U.S. National Park Service in cooperation with Univ. of Wyoming Cooperative Fish and Wildlife Research Unit, Laramie. 141 pp. 1973.
Note: new.
11. Berry, K. H. A REVIEW OF THE EFFECTS OF OFF-ROAD VEHICLES ON BIRDS AND OTHER VERTEBRATES. In: Management of Western Forests and Grasslands for Nongame Birds. Workshop Proceedings. U.S. For. Srv., Gen. Tech. Rep. INT-86, pp. 451-467. 1980.
Note: new.
12. Bess, F. H. THE EFFECT OF SNOWMOBILE NOISE ON THE HEARING MECHANISM. Proceedings of the 1971 Snowmobile and Off-Road Vehicle Research Symposium. Sponsored by the Dept. of Park and Recreation Resources, Michigan State University, East Lansing, Michigan. 1971.
Note: new.
13. Bissell, L. P. THE SOCIAL AND POLITICAL IMPACT OF SNOWMOBILES. In: Proceedings 3rd International Snowmobile Congress, Portland, Maine. pp.58-62. 1970.
Note: new.
14. Bjarvall, A. NORTH AMERICAN STUDIES ON THE EFFECTS OF SNOWMOBILES ON FAUNA. Flora Fauna. 1974.
Note: new.
15. Blangley, S. and M. E. Wood. DEVELOPING AND IMPLEMENTING ECOTOURISM GUIDELINES FOR WILDLANDS AND NEIGHBORING COMMUNITIES. In: Ecotourism: A Guide for Planners and Managers, K. Lindberg and D. E. Hawkins, eds., pp. 32-54. North Bennington, Vermont; The Ecotourism Society. 1993.
Note: new.
16. Bollinger, J. G., O. J. Rongstad, A. Soom, and R. G. Eckstein. SNOWMOBILE NOISE EFFECTS ON WILDLIFE. 1972-1973 report. Engineering Exp. Sta., Univ. of Wisconsin, Madison. 85pp. 1973.
Note: new.
17. Boucher, J. and T. A. Tattar. SNOWMOBILE IMPACT ON VEGETATION. Forest Notes 120:27-28. 1974.
Note: new.
18. Bowles, A. E. RESPONSES OF WILDLIFE TO NOISE. In: Wildlife and Recreation: Coexistence Through Management and Research, R. L. Knight and K. J. Gutzwiller, eds., pp. 109-156. Island Press. Washington, D.C. 1995.
Note: new.
19. Bowles, A. B. Tabachnick, and S. Fidell, eds. REVIEW OF THE EFFECTS OF AIRCRAFT OVERFLIGHTS ON WILDLIFE. National Park Service, Report No. 7500. 373 pp. 1991.
Note: new.
This three-volume compilation, with bibliography, reviews various studies conducted on the effects of aircraft noise on wildlife. A summary draws conclusions. Includes general disturbance factors.

20. Boyce, M. S. POPULATION VIABILITY ANALYSIS. Annu. Rev. Ecol. Syst. 23:481-506. 1992.
    Note: new.
21. Boyle, S. A. and F. B. Samson. EFFECTS OF NONCONSUMPTIVE RECREATION ON WILDLIFE: A REVIEW. Wildlife Society Bull. 13(2):110-116. 1985.
    Note: new.
    A literature review of 536 references which showed negative effects for most types of recreational activity. Suggests four management alternatives including “sacrifice” areas.
22. Boyle, S. A. and F. B. Samson. EFFECTS OF NONCONSUMPTIVE RECREATION ON WILDLIFE: A REVIEW. Wildl. Soc. Bull. 13:110-116. 1985.
    Note: new.
23. Burkey, T. V. EXTINCTION IN NATURE RESERVES: THE EFFECT OF FRAGMENTATION AND THE IMPORTANCE OF MIGRATION BETWEEN RESERVE FRAGMENTS. Oikos 55:75-81. 1989.
    Note: new.
24. Bury, R. EFFECTS OF OFF-ROAD VEHICLES ON DESERT VERTEBRATES. Bulletin of the Ecological Society of America 56(2):40. 1975.
    Note: new.
25. Bury, R. B., R. A. Luckenbach, and S. D. Busak. EFFECTS OF OFF-ROAD VEHICLES ON VERTEBRATES IN CALIFORNIA. USDI Fish & Wildlife Service. 1977.
    Note: new.
    Compared 8 paired sites. ORV use areas had significantly fewer species of vertebrates, reduced numbers of individuals and lower reptile and small mammal biomass. Censuses also showed decreased diversity, density, and biomass estimates of breeding birds in ORV used areas.
26. Cannon, H. L. and J. M. Bowles. CONTAMINATION OF VEGETATION BY TETRAETHYL LEAD. Science 137:765-766. 1988.
    Note: new.
27. Cassirer, E. F. RESPONSES OF ELK TO DISTURBANCE BY CROSS-COUNTRY SKIERS IN NORTHERN YELLOWSTONE NATIONAL PARK. M. S. Thesis, Univ. of Idaho, Moscow. 101 pp. 1990.
    Note: new.
28. Chappel, R. W. and R. J. Hudson. PREDICTION OF ENERGY EXPENDITURES BY ROCKY MOUNTAIN BIGHORN SHEEP. Can. J. Zool. 58:1908-1912. 1980.
    Note: new.
29. Cole, D. N. and P. B. Landres. INDIRECT EFFECTS OF RECREATIONISTS ON WILDLIFE. In: Wildlife and Recreation: Coexistence Through Management and Research, R. L. Knight and K. J. Gutzwiller, eds., pp. 183-202. Island Press. Washington, D.C. 1995.
    Note: new.
30. Cole, D. L. and R. L. Knight. WILDLIFE PRESERVATION AND RECREATIONAL USE: CONFLICTING GOALS OF WILDLIFE MANAGEMENT. Tran. N. Am. Wildl. Nat. Res. Conf. 56:233-237. 1991.
    Note: new.

31. Cole, G. F. GRIZZLY BEAR - ELK RELATIONSHIPS IN YELLOWSTONE NATIONAL PARK. J. Wildl. Mgmt. 36(2):556-561. 1972.
Note: new.

32. Cooke, A. S. OBSERVATIONS ON HOW CLOSE CERTAIN PASSERINE SPECIES WILL TOLERATE AN APPROACHING HUMAN IN RURAL AND SUBURBAN AREAS. Biological Conservation 18:85. 1980.
Note: new.

33. Craighead, J. J., G. Atwell and B. W. O'Gara. ELK MIGRATIONS IN AND NEAR YELLOWSTONE NATIONAL PARK. Wildl. Monog. 29. 48 pp. 1972.
Note: new.

34. Davy, B. A. and B. H. Sharp. CONTROL OF SNOWMOBILE NOISE. Environmental Protection Agency, Ofc. of Noise Abatement and Control. Springfield, VA. 1984.
Note: new.

35. deGroot, R. W. TOURISM AND CONSERVATION IN THE GALAPAGOS. Biological Conservation 26:291-300. 1983.
Note: new.

36. Despain, D. D. Houston, M. Meagher, and P. Schullery. WILDLIFE IN TRANSITION: MAN AND NATURE ON YELLOWSTONE'S NORTHERN RANGE. Roberts Rinehart. Boulder, Colo. 142 pp. 1986.
Note: new.

37. Dice, E. F. EFFECTS OF SNOWMOBILING ON ALFALFA, TREES (PINUS RESINOSA, PINUS BANKSIANA) AND SOIL BACTERIA. Ext. Bull. Michigan State Coop. Ext. Serv. East Lansing, Mich. 1976.
Note: new.

38. Dixon, K. R. and J. A. Chapman. HARMONIC MEAN MEASURE OF ANIMAL ACTIVITY AREAS. Ecology 6:1040-1044. 1980.
Note: new.

39. Doan, K. H. EFFECT OF SNOWMOBILES ON FISH AND WILDLIFE RESOURCES. Int. Assoc. Game Fish Conservation Commissioners Convention 60:97-103. New York. 1970.
Note: new.

40. Driver, B. L. and P. J. Brown. THE OPPORTUNITY SPECTRUM CONCEPT AND BEHAVIORAL INFORMATION IN OUTDOOR RECREATION SUPPLY INVENTORIES: A RATIONALE. In: Integrated Inventories and Renewable Natural Resources. Proceedings of the Workshop, eds. Lund, H.G. et al., 24-31. General Tech. Report RM-55. Fort Collins, Colo. U.S. Dept. Agric., Forest. 1978.
Note: new.

41. Dufour, P. EFFECTS OF NOISE ON WILDLIFE AND OTHER ANIMALS. Memphis State University, for United States Environmental Protection Agency, NTID 300.5. 1971.
Note: new.
Data for domestic and laboratory animals was extrapolated for wildlife. Potential impacts included masking of signals and calls. Chronic exposure could result in physiological and behavioral changes. Effects would most likely be cumulative.

42. Dunning, J. B., B. J. Danielson, and H. R. Pulliam. ECOLOGICAL PROCESSES THAT AFFECT POPULATIONS IN COMPLEX LANDSCAPES. Oikos 65:169-175. 1992.
Note: new.
43. Eckstein, R. G. and O. J. Rongstad. EFFECTS OF SNOWMOBILES ON THE MOVEMENTS OF WHITE-TAILED DEER IN NORTHERN WISCONSIN. Proc. Midwest Fish and Wildl. Conf. 35-39. 1973.
Note: new.
44. Elgmark, K. and A. Langeland. POLLUTED SNOW IN SOUTHERN NORWAY DURING WINTERS 1968-1971. Environ. Pollution 4:41-52. 1973.
Note: new.
45. Enger, P. S. , H. E. Karlsen, F. R. Knudsen, and O. Sand. DETECTION AND REACTION OF FISH TO INFRASOUND. ICES Marine Sciences Symposia 196:108-112. 1993.
Note: new.
46. Erlich, P. R. EXTINCTION: WHAT IS HAPPENING NOW AND WHAT NEEDS TO BE DONE. In: Dynamics of Extinction, D. K. Elliott, ed., pp. 157-164. John Wiley and Sons, New York. 1986.
Note: new.
47. Fahrig, L. and G. Merriam. HABITAT PATCH CONNECTIVITY AND POPULATION SURVIVAL. Ecology 66:1762-1768. 1985.
Note: new.
48. Fay, R. R. HEARING IN VERTEBRATES: A PSYCHOPHYSICS DATABOOK. Hill-Fay Associates. Winnetka, Ill. 621 pp. 1988.
Note: new.
49. Ferguson, M. A. D. and L. B. Keith. INFLUENCE OF NORDIC SKIING ON DISTRIBUTION OF MOOSE AND ELK IN ELK ISLAND NATIONAL PARK, ALBERTA. Can. Field-Nat. 99:69-78. 1982.
Note: new.
50. Ferrin, R. S. and G. P. Coltharp. LEAD EMISSIONS FROM SNOWMOBILES AS A FACTOR IN LEAD CONTAMINATION OF SNOW. Proceedings of the Utah Academy of Science, Arts and Letters 51(1):116-118. 1974.
Note: new.
51. Fletcher, J. L. and R. G. Busnel, eds. EFFECTS OF NOISE ON WILDLIFE. Academic Press, Inc., New York. 1978.
Note: new.
Several papers, including a symposium on the effects on wildlife, quantifying the acoustic dose when determining the effects of noise on wildlife, and a perspective of government and public policy regarding noise and animals.
52. Foin, T. C., E. O. Garton, C. W. Bowen, J. M. Everingham, R. O. Schultz, and B. Holton, Jr. QUANTITATIVE STUDIES OF VISITOR IMPACTS ON ENVIRONMENTS OF YOSEMITE NATIONAL PARK, CALIFORNIA, AND THEIR IMPLICATIONS FOR PARK MANAGEMENT POLICY. Journal of Environmental Management 5:1-22. 1977.
Note: new.

53. Foresman, C. L., D. K. Ryerson, R. F. Johannes, W. H. Paulson, R. E. Rand, G. H. Tenpas, D. A. Schlough, and J. W. Pendleton. EFFECTS OF SNOWMOBILE TRAFFIC ON NON-FOREST VEGETATION: SECOND REPORT. School of Natural Resources, Univ. of Wisconsin, Madison, Wisc. 1973.
    Note: new.
54. Gabrielsen, G. W. and E. N. Smith. PHYSIOLOGICAL RESPONSES OF WILDLIFE TO DISTURBANCE. In: Wildlife and Recreation: Coexistence Through Management and Research, R. L. Knight and K. J. Gutzwiller, eds., pp. 95-107. Island Press. Washington, D.C. 1995.
    Note: new.
55. Garrott, R. A. G. White, R. M. Bartman, L. H. Carpenter, and A. W. Alldredge. MOVEMENTS OF FEMALE MULE DEER IN NORTHWEST COLORADO. Journal of Wildl. Mgmt. 51(3). 1987.
    Note: new.
    Migration was strongly correlated to winter severity. Demonstrated strong fidelity to summer and winter ranges. Fidelity of individual movement patterns is long term, possibly for life.
56. Geist, V. BEHAVIOR. In: Big Game of North America: Ecology and Management, J. L. Schmidt and D. C. Gilbert, eds., pp. 283-296. Stackpole Books. Harrisburg, Penn. 494 pp. 1978.
    Note: new.
57. Gilpin, M. E. SPATIAL STRUCTURE AND POPULATION VIABILITY. In: Viable Populations for Conservation, M. E. Soule, ed., pp. 124-139. Cambridge University Press. 1987.
    Note: new.
58. Gipson, P. S. ABORTION AND CONSUMPTION OF FETUSES BY COYOTES FOLLOWING ABNORMAL STRESS. Southwestern Naturalist 21:558-559. 1970.
    Note: new.
59. Graefe, A. R., F. R. Kruss, and J. J. Vaske. VISITOR IMPACT MANAGEMENT: THE PLANNING FRAMEWORK. National Parks and Conservation Association. Washington, D.C. 105 pp. 1990.
    Note: new.
60. Graefe, A. R., F. R. Krass, and J. J. Vaske. VISITOR IMPACT MANAGEMENT. Vols. I and II. National Parks and Conservation Association. Washington, D.C. 1990.
    Note: new.
61. Graul, W. D. and G. C. Miller. STRENGTHENING ECOSYSTEM MANAGEMENT APPROACHES. Wildl. Soc. Bull. 12:282-289. 1984.
    Note: new.
62. Gray, J. A. PSYCHOLOGY OF FEAR AND STRESS, 2ND ED. Cambridge University Press. New York. 1987.
    Note: new.
63. Greer, T. ENVIRONMENTAL IMPACT OF SNOWMOBILES: A REVIEW OF THE LITERATURE. Univ. of Oregon, Portland, Ore. 1979.
    Note: new.

64. Gregory, S. V., F. J. Swanson, W. A. McKee, and K. W. Cummins. AN ECOSYSTEM PERSPECTIVE OF RIPARIAN ZONES. BioScience 41:540-551. 1991.
Note: new.

65. Greller, A. M., et al. SNOWMOBILE IMPACT ON THREE ALPINE TUNDRA PLANT COMMUNITIES. Environmental Conservation 1(2):101-110. 1974.
Note: new.

66. Gutzwiller, K. J. RECREATIONAL DISTURBANCE AND WILDLIFE COMMUNITIES. In: Wildlife and Recreation: Coexistence Through Management and Research, R. L. Knight and K. J. Gutzwiller, eds., pp. 169-181. Island Press. Washington, D.C. 1995.
Note: new.

67. Gutzwiller, K. J. RECREATIONAL DISTURBANCE AND WILDLIFE COMMUNITIES. In: Wildlife and Recreation: Coexistence Through Management and Research, R. L. Knight and K. J. Gutzwiller, eds., pp. 169-181. Island Press. Washington, D.C. 1995.
Note: new.

68. Hagen, A. and A. Langeland. POLLUTED SNOW IN SOUTHERN NORWAY AND THE EFFECT OF THE MELTWATER ON FRESHWATER AND AQUATIC ORGANISMS. Environ. Pollution 5:45-57. 1973.
Note: new.

69. Haines, H. E. J. SNOWMOBILES IN YELLOWSTONE: BIOMASS ALTERNATIVES TO REDUCE POLLUTION. Montana Dept. of Environmental Quality. Survey of Visitor Impact on Wildlife. Curtis Canyon Area, National Elk Refuge, Jackson, Wyo. 1984.
Note: new.

70. Hammitt, W. E. and D. N. Cole. WILDLAND RECREATION: ECOLOGY AND MANAGEMENT. John Wiley and Sons. New York.
Note: new.

71. Hare, C. T. and K. J. Springer. SNOWMOBILE ENGINE EMISSIONS AND THEIR IMPACT. Office of Air and Water Programs, Environmental Protection Agency, Southwest Research Institute. San Antonio, Tex. 1974.
Note: new.

72. Harris, L. D. and P. B. Gallagher. NEW INITIATIVES FOR WILDLIFE CONSERVATION: THE NEED FOR MOVEMENT CORRIDORS. In: Conservation Biology: The Theory and Practice of Nature Conservation, Preservation, and Management, P. L. Fiedler and S. K. Jain, eds., pp. 197-237. Chapman and Hall. New York. 1989.
Note: new.

73. Harrison, R. T. PREDICTING SNOWMOBILE ACOUSTIC IMPACT ON RECREATIONISTS. U. S. For. Ser. Equp. Dev. Center, ED&T Project No. 9227. San Dimas, Calif. 1980.
Note: new.

74. Hartmata, A. R. GREATER YELLOWSTONE BALD EAGLE MANAGEMENT PLAN. Greater Yellowstone Bald Eagle Working Group, Wyo. Game and Fish Dept., Lander, Wyo. 47 pp. 1996.
Note: new.

75. Hendee, J. C., G. H. Stankey, and R. C. Lucas. WILDERNESS MANAGEMENT. Misc. Publ. No. 1365. USFS, Dept. of Agric. 38 pp. 1978.
Note: new.

76. Henry, W. RELATIONSHIPS BETWEEN VISITOR USE AND CAPACITY FOR KENYA'S AMBOSELI NATIONAL PARK. Ph.D. Dissertation. Fort Collins, Colorado: Colorado State University. 1980.
Note: new.

77. Horney, R. L. SNOWMOBILING: GUIDELINES, ENVIRONMENTAL IMPACT, LEGISLATION, PROGRAMMING. National Recreation and Park Association. Washington, D.C. 1970.
Note: new.

78. Hudson, R. J. and R. J. Christopherson. MAINTENANCE METABOLISM. In: Bioenergetics of Wild Herbivores, R. J. Hudson and R. G. White, eds. CRC Press. Boca Raton, Fla. 314 pp. 1986.
Note: new.

79. Irwin, L. and J. Peek. RELATIONSHIP BETWEEN ROAD CLOSURES AND ELK BEHAVIOR IN NORTHERN IDAHO. University of Idaho and USDA Forest Service, Technical Report. 1979.
Note: new.

80. Ittner, R. D., D. R. Potter, J. K. Agee, and S. Anschell, eds. Conf. Proceedings: RECREATIONAL IMPACTS ON WILDLANDS. U. S. For. Serv. and U. S. Natl. Park Serv., R-6-001. Seattle, Wash. 341 pp. 1979.
Note: new.

81. Jacobsen, N. K. ALARM BRADYCARDIA IN WHITE-TAILED DEER FAWNS. Jour. of Mammalogy 60:343-349. 1979.
Note: new.
The near approach of humans will cause newborn fawns to drop to the ground. After 2 weeks old, the same stimulus will cause them to run.

82. Jarvinen, J. A. and W. D. Schmidt. SNOWMOBILE USE AND WINTER MORTALITY OF SMALL MAMMALS. In: Proceedings of the 1971 Snowmobile and Off the Road Vehicle Research Symposium, M. Chubb, ed., pp. 130-140, Tech. Rep. No. 8, Recreation Research and Planning Unit, Dept. Park and Recreation Resour. Michigan State Univ., East Lansing. 196 pp. 1971.
Note: new.
Study area: Minnesota. Used traps. Meadow vole, short-tailed shrew, white-footed mouse, ground squirrel, masked shrew and spotted skunk. Study showed increased mortality of small mammals, destroyed subnivean air spaces. Also a possibility of toxic air trapped in snow. Even conservative levels of snowmobiling on trails is destructive to wintering small mammals.

83. Johnson, T. H. RESPONSES OF BREEDING PEREGRINE FALCONS TO HUMAN STIMULI. In: Proc. Southwest Raptor Management Symposium and Workshop, Gilinski et al., eds. National Wildlife Federation. Washington, D.C. 1988.
Note: new.

84. Keddy, P. A., A. J. Spaovld, and C. J. Keddy. SNOWMOBILE IMPACT ON OLD FIELD AND MARSH VEGETATION IN NOVA SCOTIA, CANADA: AN EXPERIMENTAL STUDY. Environmental Management 3:409-415. 1979.
Note: new.

85. Keller, S. R. and J. K. Berry. A BIBLIOGRAPHY OF HUMAN/ANIMAL RELATIONS. Univ. Press of America. Lanham, MD. 1985.
Note: new.

86. King, M. M. and G. W. Workman. RESPONSE OF DESERT BIGHORN SHEEP TO HUMAN HARASSMENT: MANAGEMENT IMPLICATIONS. Transactions of the North American Wildlife and Natural Resources Conference 51:74-85. 1986.
Note: new.

87. Kirby, R. E. IMPACT OF HUMAN ACTIVITY UPON WILDLIFE AND WILDLIFE HABITAT. Statement of Work, Office Info. Transfer, Res. and Develop., U. S. Fish and Wildl. Serv. 3 pp. 1985.
Note: new.

88. Kirkpatrick, C. M., ed. PROCEEDINGS: WILDLIFE AND PEOPLE. Dept. For. Nat. Resour., Purdue Univ., Lafayette, Ind. 191 pp. 1985.
Note: new.

89. Knight, R. L. and S. K. K. Skagen. EFFECTS OF RECREATIONAL DISTURBANCE ON BIRDS OF PREY: A REVIEW. In: Proceedings of the Southwest Raptor Management Symposium and Workshop, L. Glinski et al., eds., pp. 355-359. National Wildlife Federation. Washington, D.C. 1988.
Note: new.

90. Knight, R. L. and D. N. Cole. FACTORS THAT INFLUENCE WILDLIFE RESPONSES TO RECREATIONISTS. In: Wildlife and Recreationists: Coexistence Through Management and Research, R. L. Knight and K. J. Gutzwiller, eds., pp. 71-79. 1995.
Note: new.

91. Knight, R. L. and K. J. Gutzwiller, eds. WILDLIFE AND RECREATIONISTS: COEXISTENCE THROUGH MANAGEMENT AND RESEARCH. Island Press. Washington, D.C. 372 pp. 1995.
Note: new.
Physiological and psychological responses, indirect effects, management strategies, case histories, ethics, historical perspectives.

92. Knight, S. K. and R. L. Knight. VIGILANCE PATTERNS OF BALD EAGLES FEEDING IN GROUPS. Auk 103:263-272. 1986.
Note: new.

93. Kopischke, E. D. EFFECTS OF SNOWMOBILE ACTIVITY ON THE DISTRIBUTION OF WHITE-TAILED DEER IN SOUTH CENTRAL MINNESOTA. Dept. Nat. Res. Game Research Proj. Rept. 1972.
Note: new.

94. Krueger, C. D. J. Decker, and T. A. Gavin. A CONCEPT OF NATURAL RESOURCE MANAGEMENT: AN APPLICATION TO UNICORNS. Trans. Northeast Sect. Wildl. Soc. 43:50-56. 1986.
Note: new.
A simplified, idealized conceptual model for resource management.

95. Kugler, B. A. and D. S. Barber. A METHOD FOR MEASURING WILDLIFE NOISE EXPOSURE IN THE FIELD (Abstract). Journ. of the Acoustical Society of America 93(4):2378. 1993.
Note: new.

96. Kuss, F. R., A. R. Graefe, and J. J. Vaske. VISITOR IMPACT MANAGEMENT: A REVIEW OF RESEARCH. National Parks and Conservation Association. Washington, D.C. 362 pp. 1990.
Note: new.

97. Lacey, R. M., R. S. Baran, W. D. Severinghaus, and D. J. Hunt. EVALUATION OF LANDS FOR RECREATIONAL SNOWMOBILE USE (GUIDELINES FOR NATURAL RESOURCES MANAGEMENT AND LAND USE COMPATIBILITY). Construction Engineering Research Lab.(Army). Champaign, Ill. 1981.
Note: new.

98. Lee, M. E., D. R. Field, and K. Schwarzkopf. PEOPLE, HUMAN BEHAVIOR AND ANIMALS IN PARKS AND PRESERVES: A WORKING BIBLIOGRAPHY. Natl. Park Serv., Coop. Park Stud. Unit Publ. CPSU/OSU 84-11. Coll. For., Oregon State Univ., Corvallis. 35 pp. 1984.
Note: new.

99. Lieb, J. W. ACTIVITY, HEART RATE, AND ASSOCIATED ENERGY EXPENDITURE IN ELK OF WESTERN MONTANA. Ph.D. Thesis, Univ. of Montana, Missoula. 200 pp. 1981.
Note: new.

100. Lindberg, K. and D. E. Hawkins, eds. ECOTOURISM: A GUIDE FOR PLANNERS AND MANAGERS. The Ecotourism Society. North Bennington, Vermont. 1993.
Note: new.

101. Lindenmayer, D. B. and H. A. Nix. ECOLOGICAL PRINCIPLES FOR THE DESIGN OF WILDLIFE CORRIDORS. Conservation Biology 7:627-630. 1973.
Note: new.

102. Lodico, N. J. ENVIRONMENTAL EFFECTS OF OFF-ROAD VEHICLES: A REVIEW OF THE LITERATURE. USDI Office of the Secretary, Washington, D.C. 1973.
Note: new.

103. Lyon, L. J. ROAD DENSITY MODELS DESCRIBING HABITAT EFFECTIVENESS FOR ELK. Journal of Forestry, September:592-595. 1983.
Note: new.
Forest roads evoke an avoidance response by elk.

104. MacAarthur, R. H. and E. O. Wilson. THEORY OF ISLAND BIOGEOGRAPHY. Princeton University Press. Princeton, N.J. 1967.
Note: new.

105. MacNab, J. WILDLIFE MANAGEMENT AS SCIENTIFIC EXPERIMENTATION. Wildl. Soc. Bull. 11:397-401. 1983.
Note: new.

106. Maldague, M. IMPACT OF SNOWMOBILES ON THE FOREST ENVIRONMENT. Forest Conservation 39(9):6-8. 1973.
Note: new.

107. Manfredo, M. J., J. J. Vaske, and D. J. Decker. HUMAN DIMENSIONS OF WILDLIFE MANAGEMENT: BASIC CONCEPTS. In: Wildlife and Recreationists: Coexistence Through Management and Research, R. L. Knight and K. J. Gutzwiller, eds., pp. 17-31. Island Press. Washington, D.C. 1995.
Note: new.

108. Manning, R. E. IMPACTS OF RECREATION ON RIPARIAN SOILS AND VEGETATION. Water Resources Bulletin 50:30-43. 1979.
Note: new.

109. Manuwal, D. A. EFFECT OF MAN ON MARINE BIRDS: A REVIEW. In: Proc. Wildlife and People, C. M. Kirkpatrick, ed., pp. 140-160. Purdue Res. Foundation. West Lafayette, Ind. 1978.
Note: new.

110. Marshall, O. PRELIMINARY STUDIES ON THE EFFECTS OF SNOWMOBILE COMPACTION ON SOME TERRESTRIAL INVERTEBRATES. Amer. Zool. 1972.
Note: new.

111. Masyk, W. J. SNOWMOBILE, A RECREATION TECHNOLOGY IN BANFF NATIONAL PARK; ENVIRONMENTAL IMPACT AND DECISION-MAKING. Univ. of Calgary; The Univ. of Western Ontario, London, Ontario. 1973.
Note: new.

112. Mayes, A. THE PHYSIOLOGY OF FEAR AND ANXIETY. In: Fear in Animals and Man, W. Sluckin, ed., pp. 24-55. Van Nostrand Reinhold Company, New York, N.Y. 1979.
Note: new.
Physiological and behavioral responses to disturbance.

113. McCool, S. F. SNOWMOBILES, ANIMALS, AND MAN: INTERACTIONS AND MANAGEMENT ISSUES. Trans. North Amer. Wildl. and Nat. Resour. Conf. 43:140-148. 1978.
Note: new.

114. McCool, S. F. SNOWMOBILES, ANIMALS, AND MAN: INTERACTIONS AND MANAGEMENT ISSUES. The Wildlife Management Institute. Washington, D.C. 23 pp. 1978.
Note: new.

115. McCool, S. F. and B. Curtis. SOURCES OF CONFLICT AMONG WINTER RECREATIONISTS. In: Proc. North American Symposium on Dispersed Winter Recreation, pp. 73-77. Univ. of Minn. Office of Spec. Prog., Educ. Ser. 2-3. 1980.
Note: new.

116. Meagher, M. S. Cain, T. Toman, J. Kropp, and D. Bosman. BISON IN THE GREATER YELLOWSTONE AREA: STATUS, DISTRIBUTION AND MANAGEMENT. Paper presented at the National Brucellosis Symposium, Jackson Hole, Wyo., September. 1994.
Note: new.
117. Meagher, M. THE BISON OF YELLOWSTONE NATIONAL PARK: PAST AND PRESENT. Ph.D. Dissertation, Univ. of Calif., Berkeley. 172 pp. 1970.
Note: new.
118. Meagher, M. RANGE EXPANSION BY BISON OF YELLOWSTONE NATIONAL PARK. Journal of Mammal. 70:670-675. 1989.
Note: new.
Bison use of plowed roads, an increase in numbers, acquired knowledge of new foraging areas, and the natural gregariousness of bison contributed to range expansion.
119. Meagher, M. WINTER WEATHER AS A POPULATION REGULATING INFLUENCE ON FREE-RANGING BISON IN YELLOWSTONE NATIONAL PARK. In: Research in Parks, Transactions of the National Park Centennial Symposium of the American Association for the Advancement of Science, Dec. 28-29, 1971. Ser. No. 1. Washington, D.C.: U.S. Government Printing Office. 232 pp. 1976.
Note: new.
120. Meagher, M. WINTER RECREATION-INDUCED CHANGES IN BISON NUMBERS AND DISTRIBUTION IN YELLOWSTONE NATIONAL PARK. Draft, report to management, unpublished. 48 pp. 1993. Research Library, vertical files, Yellowstone Park, Wyoming.
Note: new.
Snow-packed roads used for winter recreation in the interior of the park appeared to be the major influence in major changes that occurred in bison numbers and distribution in Yellowstone, during the past decade. The entire bison population is involved, effects will ultimately occur on the ecosystem level. Range expansion, major shifts among subpopulations, mitigation of winterkill, and enhanced calf survival have resulted.
121. Meagher, M. WINTER RECREATION-INDUCED CHANGES IN BISON NUMBERS AND DISTRIBUTION IN YELLOWSTONE NATIONAL PARK. Unpublished. 1993.
Note: new.
122. Mietz, J. D. SNOWMOBILE IMPACT ON FOREST VEGETATION AT HEIBERG FOREST, NEW YORK. State University of New York, College of Environmental Science and Forestry, Syracuse, N.Y. 1974.
Note: new.
123. Miller, S. G. and R. L. Knight. IMPACTS OF RECREATIONAL TRAILS ON AVIAN COMMUNITIES. In: Abstracts from the Society of Conservation Biology Meeting. Dept. of Fishery and Wildlife Biology, Colorado State University, Fort Collins, Colo. 1995.
Note: new.
124. Moen, A. N., S. Whittemore, and B. Buxton. EFFECTS OF DISTURBANCE BY SNOWMOBILES ON HEART RATE OF CAPTIVE WHITE-TAILED DEER (*Odocoileus virginianus*). New York Fish and Game Journal 29(2):176-183. 1982.
Note: new.

125. Montana Department of Fish, Wildlife and Parks. PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT. Montana Snowmobile Grant Program. Prepared by Statewide Trails Program Coordinator, Montana Dept. of Fish, Wildlife and Parks, 1420 E. Sixth Ave., Helena, Mont. 59620. 1993.
Note: new.
126. Montopoli, G. L. and D. A. Anderson. LOGISTICAL MODEL FOR THE CUMULATIVE EFFECTS OF HUMAN INTERVENTION ON BALD EAGLE HABITAT. Jour. Wildl. Manage. 55:290-293. 1991.
Note: new.
127. Morrison, J. R. EFFECTS OF SKI AREA EXPANSION ON ELK AND ACCURACY OF TWO TELEMETRY SYSTEMS IN MOUNTAINOUS TERRAIN. M. S. Thesis, Colorado State University, Fort Collins, Colo. 98 pp. 1992.
Note: new.
128. Noss, R. F. and A. Y. Cooperrider. SAVING NATURE'S LEGACY: PROTECTING AND RESTORING BIODIVERSITY. Island Press. Washington, D.C. 1994.
Note: new.
129. Odum, E. P. TRENDS EXPECTED IN STRESSED ECOSYSTEMS. BioScience 35:419-422. 1985.
Note: new.
130. Pederson, R. J. MANAGEMENT AND IMPACTS OF ROADS IN RELATION TO ELK POPULATIONS. In: Conf. Proc. Recreational Impact on Wildlands, R. Ittner, D. R. potter, J. K. Agee, and S. Anschell, eds., pp. 169-173. U.S. Forest Serv., U.S. Natl. Park Serv. R-6-001-1979. 1979.
Note: new.
Construction of roads in elk habitat effectively eliminated prime areas from elk production.
131. Pedevillano, C. and R. G. Wright. INFLUENCE OF VISITORS ON MOUNTAIN GOAT ACTIVITIES IN GLACIER NATIONAL PARK. Biological Conservation 39:1-11. 1987.
Note: new.
Goats at mineral licks apparently not disturbed by visitors, but goats attempting to cross goat underpasses were negatively affected by numbers of vehicles on the highway.
132. Peek, J. and D. B. Siniff. WILDLIFE-SNOWMOBILE INTERACTIONN PROJECT: PROGRESS REPORT. Univ. Minnesota Dept. Entom., Fish, Wildl., Ecol. and Behav. Biol., and Minn. Dept. of Natural Resources, St. Paul, Minn. 1972.
Note: new.
133. Perry, C. and R. Overly. IMPACT OF ROADS ON BIG GAME DISTRIBUTION IN PORTIONS OF THE BLUE MOUNTAINS OF WASHINGTON, 1972-1973. Washington Game Department. 1976.
Note: new.
General reduction of use up to 1/8 mile from roads, depending on amount of roadside cover; deer substantially affected in meadows when cover was lacking.

134. Pruitt, W. O. SNOWMOBILES AND ALL-TERRAIN VEHICLES. Paper presented at Conference on Snowmobiles and All-Terrain Vehicles. Univ. of Western Ontario, Dept. Zool. Res. Report, University of Manitoba, Winnipeg, Canada. 1971.
Note: new.
Discussed impacts of snowmobiles on the subnivean environment.
135. Purdy, K. G., G. R. Goff, D. J. Decker, G. A. Pomerantz, and N. A. Connelly. GUIDE TO MANAGING HUMAN ACTIVITY ON NATIONAL WILDLIFE REFUGES. USDI Fish and Wildlife Service, Office of Information Transfer. Fort Collins, Colorado. 1987.
Note: new.
136. Rapport, D. J., H. A. Regier, and T. C. Hutchinson. ECOSYSTEM BEHAVIOR UNDER STRESS. American Naturalist 125:617-640. 1985.
Note: new.
137. Regelin, W. L., C. C. Schwartz, and A. W. Franzmann. SEASONAL ENERGY METABOLISM IN MOOSE. J. Wildl. Manage. 49:388-393. 1985.
Note: new.
138. Renecker, L. A. and R. J. Hudson. SEASONAL ENERGY EXPENDITURES AND THERMOREGULATORY RESPONSES OF MOOSE. Can. Jour. Zoology 64:322-327. 1986.
Note: new.
139. Roggenbuck, J. W. USE OF PERSUASION TO REDUCE RESOURCE IMPACTS AND VISITOR CONFLICTS. In: Influencing Human Behavior, M. J. Manfredo, ed., pp. 149-208. Sagamore Publishing, Inc. Champaign, Ill. 1992.
Note: new.
140. Rongstad, O. J. RESEARCH NEEDS ON ENVIRONMENTAL IMPACTS OF SNOWMOBILES. In: Off-road Vehicle Use: A Management Challenge, N. Andrews, L. Richard, and P. Nowak, eds., USDA Ofc. of Environmental Quality. Washington, D.C. 1980.
Note: new.
141. Rosenmann, M. and P. Morrison. PHYSIOLOGICAL CHARACTERISTICS OF THE ALARM REACTION IN THE DEER MOUSE. Physiological Zoologica 47:230-241. 1974.
Note: new.
142. Rost, G. A. and J. A. Bailey. DISTRIBUTION OF MULE DEER AND ELK IN RELATION TO ROADS. J. Wildl. Manage. 43:634-641. 1979.
Note: new.
143. Ruggiero, L. F., G. D. Hayward, and J. R. Squires. VIABILITY ANALYSIS IN BIOLOGICAL EVALUATIONS: CONCEPTS OF POPULATION VIABILITY ANALYSIS, BIOLOGICAL POPULATION, AND ECOLOGICAL SCALE. Conservation Biology 8(2):364-372. 1994.
Note: new.
Reviewed population viability analysis (PVA). Suggested that assessments must address population persistence and habitat dynamics. A 7-step guide for PVA was provided.
144. Russell, D. OCCURRENCE AND HUMAN DISTURBANCE SENSITIVITY OF WINTERING BALD EAGLES ON THE SAUK AND SUIATTLE RIVERS, WASHINGTON. In: Proceedings of Washington Bald Eagle Symposium, R. L. Knight, G. T. Allen, M. V. Stalmaster, and C. W. Servheen, eds., pp. 165-174. 1980.
Note: new.

145. Sachet, G. A. INTEGRATED TRAIL PLANNING GUIDELINES FOR WILDLIFE, RECREATION AND FISH RESOURCES ON MT. HOOD NATIONAL FOREST. USDA Forest Service. 1990.
Note: new.
146. Salwasser, H. and F. Samson. CUMULATIVE EFFECTS ANALYSIS: AN ADVANCE IN FOREST PLANNING AND WILDLIFE MANAGEMENT. Tran. No. Amer. Wildl. and Nat. Res. Conf. 50:313-321. 1985.
Note: new.
147. Salwasser, H. C. Schoenwald-Cox, and R. Baker. ROLE OF INTERAGENCY COOPERATION IN MANAGING FOR VIABLE POPULATIONS. In: Viable Populations for Conservation, M. E. Soule, ed., pp. 159-173. Cambridge University Press. 1972.
Note: new.
148. Samuel, M. D. and R. E. Green. A REVISED TEST PROCEDURE FOR IDENTIFYING CORE AREAS WITHIN THE HOME RANGE. J. An. Ecology 57:1067-1068. 1988.
Note: new.
Revised his 1985 paper in same journal.
149. Schleyer, B. O. ACTIVITY PATTERNS OF GRIZZLY BEARS IN THE YELLOWSTONE ECOSYSTEM AND THEIR REPRODUCTIVE BEHAVIOR, PREDATION, AND USE OF CARRION. M. S. Thesis, Montana State Univ., Bozeman, Mont. 1983.
Note: new.
150. Schmid, W. D. MODIFICATION OF THE SUBNIVEAN MICROCLIMATE BY SNOWMOBILES. In: Snow and Ice in Relation to Wildlife and Recreation, Symposium Proceedings, pp. 251-257. Coop. Wildl. Res. Unit, Iowa State Univ., Ames, IA. 1971.
Note: new.
151. Schultz, R. D. RESPONSES OF NATIONAL PARK ELK TO HUMAN ACTIVITY. M.S. thesis. Univ. of Montana. 95 pp. 1975.
Note: new.
152. Scom, A. J. G. Bollinger, and O. J. Rongstad. STUDYING THE EFFECTS OF SNOWMOBILE NOISE ON WILDLIFE. Internoise Proceedings 236-241. 1972.
Note: new.
153. Shaffer, M. L. MINIMUM VIABLE POPULATIONS COPING WITH UNCERTAINTY. In: Viable Populations for Conservation, M. E. Soule, ed., pp. 69-86. Cambridge University Press, Cambridge. 1987.
Note: new.
154. Shaffer, M. L. POPULATION VIABILITY ANALYSIS. Conservation Biology 4(1):39-40. 1990.
Note: new.
155. Shaffer, M. L. POPULATION VIABILITY ANALYSIS. In: Challenges in Conservation of Biological Resources: A Practioner's Guide, D. Decker et al., eds., pp. 107-119. Westview Press. San Francisco, Calif. 1992.
Note: new.
156. Shea, R. E. ECOLOGY OF THE TRUMPETER SWAN IN YELLOWSTONE NATIONAL PARK AND VICINITY. M. S. thesis. Univ. of Montana. 132 pp. 1979.
Note: new.

157. Shoesmith, M. W. SEASONAL MOVEMENTS AND SOCIAL BEHAVIOR OF ELK ON MIRROR PLATEAU, YELLOWSTONE NATIONAL PARK. In: North American Elk: Ecology, Behavior and Management, M. S. Boyce and L. D. Hayden-Wing, eds., pp. 166-176. Univ. of Wyoming, Laramie, Wyo. 1980.
Note: new.
158. Simberloff, D. and J. Cox. CONSEQUENCES AND COSTS OF CONSERVATION CORRIDORS. Conserv. Biol. 1:63-71. 1987.
Note: new.
159. Simberloff, D. and L. G. Abele. REFUGE DESIGN AND ISLAND BIOGEOGRAPHIC THEORY: EFFECTS OF FRAGMENTATION. Am. Nat. 120:41-50. 1987.
Note: new.
160. Singer, F. J. and J. B. Beattie. CONTROLLED TRAFFIC SYSTEM AND ASSOCIATED RESPONSES IN DENALI NATIONAL PARK. Arctic 39:195-203. 1986.
Note: new.
Moose were more alert to vehicle traffic than were caribou.
161. Skagen, S. K. BEHAVIORAL RESPONSES OF WINTERING BALD EAGLES TO HUMAN ACTIVITY ON THE SKAGIT RIVER, WASHINGTON. In: Proceedings of the Washington Bald Eagle Symposium, R. L. Knight et al., eds. The Nature Conservancy. 1980.
Note: new.
162. Smith, A. T. and M. M. Peacock. CONSPECIFIC ATTRACTION AND THE DETERMINATION OF METAPOPULATION COLONIZATION RATES. Conservation Biology 4:320-323. 1990.
Note: new.
Recolonization of habitats after disturbance.
163. Soule, M. E. and D. Simberloff. WHAT DO GENETICS AND ECOLOGY TELL US ABOUT THE DESIGN OF NATURE RESERVES? Biol. Conservation 35:19-40. 1986.
Note: new.
164. Stace-Smith, R. MISUSE OF SNOWMOBILES AGAINST WILDLIFE IN CANADA. Nat. Can. 494:3-8. Ottawa. 1975.
Note: new.
165. Stalmaster, M. V. and J. A. Gessaman. ECOLOGICAL ENERGETICS AND FORAGING BEHAVIOR OF OVERWINTERING BALD EAGLES. Ecological Monographs 54:407-428. 1984.
Note: new.
High levels of human disturbance during winter could increase energy demands and result in increased mortality rates.
166. Stalmaster, M. V., J. K. Kaiser, and S. K. Skagen. EFFECTS OF RECREATIONAL ACTIVITY ON FEEDING BEHAVIOR OF WINTERING BALD EAGLES. J. Raptor Research 27(1):93. 1983.
Note: new.

167. Stankey, G. H., D. N. Cole, R. C. Lucas, M. E. Peterson, and S. S. Frissell. LIMITS OF ACCEPTABLE CHANGE (LAC) SYSTEM FOR WILDERNESS PLANNING. General Technical Report INT-176. USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, Utah. 19815.
Note: new.
Follows carrying capacity concepts (no set number of visitors). Sets quantifiable standards of impact levels that trigger management actions.

168. Stemp, R. E. HEART RATE RESPONSES OF BIGHORN SHEEP TO ENVIRONMENTAL FACTORS AND HARASSMENT. M. S. Thesis, Univ. of Calgary, Alberta, Canada. 371 pp. 1983.
Note: new.

169. Stockwell, C. A., G. C. Bateman, and J. Berger. CONFLICTS IN NATIONAL PARKS: A CASE STUDY OF HELICOPTERS AND BIGHORN SHEEP TIME BUDGETS AT GRAND CANYON. Biological Conservation 56:317-328.
Note: new.
Frequent alerting affected food intake.

170. Sweeney, J. M. and J. R. Sweeney. SNOW DEPTHS INFLUENCING WINTER MOVEMENTS OF ELK. Jour. of Mammalogy 65(3):524-526. 1984.
Note: new.

171. Taylor, C. R., N. C. Heglund, and G. M. Maloiy. ENERGETICS AND MECHANICS OF TERRESTRIAL LOCOMOTION. Jour. Exp. Biol. 97:1-21. 1982.
Note: new.

172. Telfer, E. S. and J. P. Kelsall. STUDIES OF MORPHOLOGICAL PARAMETERS AFFECTING UNGULATE LOCOMOTION IN SNOW. Can. Jour. Zool. 57:2153-2159. 1982.
Note: new.

173. Tennessee State University, Memphis. EFFECTS OF NOISE ON WILDLIFE AND OTHER ANIMALS. U.S. Govt. Printing Ofc., Washington, D.C. 74 pp. 1971.
Note: new.
Prepared for U.S. Ofc. of Noise Abatement and Control.

174. Tenpas, G. H. EFFECTS OF SNOWMOBILE TRAFFIC ON NON-FOREST VEGETATION. Lake Superior Biological Conference, Ashland, Wisc. 1972.
Note: new.

175. Thomas, J. W., ed. WILDLIFE HABITATS IN MANAGED FORESTS IN THE BLUE MOUNTAINS OF OREGON AND WASHINGTON. USDA Forest Service Handbook 553. 512 pp. 1979.
Note: new.
A most comprehensive study of deer and elk management. Provides tools for identifying cover and vegetation types. Quantifies impacts from management activities, including roads.

176. Thorne, E. T., R. E. Dean, and W. G. Hepworth. NUTRITION DURING GESTATION IN RELATION TO SUCCESSFUL REPRODUCTION IN ELK. J. Wildl. Manage. 40:330-335. 1976.
Note: new.

177. University of Wisconsin, Madison. EFFECTS OF SNOWMOBILE TRAFFIC ON NON-FOREST VEGETATION: SECOND REPORT. College of Agricultural and Life Sciences, Dept. of Agronomy, Univ. of Wisconsin, Madison. 1973.
Note: new.

178. USDI, U.S. National Park Service. PUBLIC USE AND RECREATION; VEHICLES AND TRAFFIC SAFETY. Federal Register 38. Feb. 14, 1973:4405-4407. 1973.
Note: new.

179. USDI, U.S. National Park Service. WINTER USE PLAN ENVIRONMENTAL ASSESSMENT, YELLOWSTONE AND GRAND TETON NATIONAL PARKS AND JOHN D. ROCKEFELLER, JR., MEMORIAL PARKWAY, WYOMING, IDAHO, AND MONTANA. 114 pp. 1990.
Note: new.

180. VanDyke, F. G., R. H. Brocke, H. G. Shaw, B. B. Ackerman, T. P. Hemker, and F. G. Lindzey. REACTIONS OF MOUNTAIN LIONS TO LOGGING AND HUMAN ACTIVITY. J. Wildl. Manage. 50:95-102. 1986.
Note: new.

181. Vaske, J. J., D. J. Decker, and M. J. Manfredo. HUMAN DIMENSIONS AND WILDLIFE MANAGEMENT: AN INTEGRATED FRAMEWORK FOR COEXISTENCE. In: Wildlife and Recreation: Coexistence Through Management and Research, R. L. Knight and K. J. Gutzwiller, eds., pp. 33-49. Island Press. Washington, D.C. 1995.
Note: new.

182. Vaske, J. J., A. R. Graefe, and F. R. Kuss. RECREATION IMPACTS: A SYNTHESIS OF ECOLOGICAL AND SOCIAL RESEARCH. Trans. North Amer. Wildl. and Nat. Resour. Conf. 48:96-107. 1983.
Note: new.

183. Wallace, G. N. VISITOR MANAGEMENT: LESSONS FROM GALAPAGOS NATIONAL PARK. In: Ecotourism: A Guide for Planners and Managers, K. Lindberg and D. E. Hawkins, eds., pp.55-81. The Ecotourism Society. North Bennington, Vermont. 1993.
Note: new.

184. Walter, H. and K. L. Garrett. EFFECTS OF HUMAN ACTIVITY ON WINTERING BALD EAGLES IN THE BIG BEAR VALLEY, CALIFORNIA. FINAL REPORT. USDA Forest Service, Big Bear District, Fawnskin, Calif. 79 pp. 1981.
Note: new.
Snow machines and ATVs are especially disturbing, probably due to association with random movement, loud noise, and operators are generally exposed.

185. Wanek, W. J. and L. H. Schumacher. A CONTINUING STUDY OF THE ECOLOGICAL IMPACT OF SNOWMOBILING IN NORTHERN MINNESOTA. FINAL REPORT FOR 1974-1975. State College, Bemidji, Minn. 1975.
Note: new.

186. Wanek, W. J. ECOLOGICAL IMPACT ON VEGETATION AND SOIL MICROBES. In: Snowmobile and Off the Road Vehicle Research Symposium Proceedings. Recreation Resour., Michigan State Univ. 1973.
Note: new.

187. Wanek, W. J. SNOWMOBILING IMPACT ON VEGETATOIN, TEMPERATURES AND SOIL MICROBES. In: Snowmobile and Off the Road Vehicle Research Symposium Proceedings, pp. 117-130. 1971.
Note: new.

188. Ward, A. L. EFFECTS OF HIGHWAY CONSTRUCTION AND USE ON BIG GAME POPULATIONS. Fed. Highway Ofc. Res. and Dev. Rep. FHWA-RD-76-174. Nat. Tech. Inf. Serv., Springfield, Va. 92 pp. 1976.
Note: new.

189. Ward, A. L. TELEMETERED HEART RATE OF THREE ELK AS AFFECTED BY ACTIVITY AND HUMAN DISTURBANCES. In: Proceedings of Symposium: Dispersed Recreation and Natural Resource Management. Utah State Univ. 1977.
Note: new.
Two cow elk and a spike. Positive correlation to man-caused disturbance and elevated heart rates. Highest incidence occurred with loud noises and direct interaction.

190. Ward, A. L. and J. J. Cupal. TELEMETERED HEART RATE OF THREE ELK AS AFFECTED BY ACTIVITY AND HUMAN DISTURBANCE. Rocky Mt. Forest and Range Exper. Sta., Laramie, Wyo. 1980.
Note: new.

191. Warren, H. V. and R. E. Delavault, cited in H. L. Cannon and J. M. Bowles. CONTAMINATION OF VEGETATION BY TETRAETHYL LEAD. Science 137:765-766.
Note: new.

192. Watson, A. BIRD AND MAMMAL NUMBERS IN RELATION TO HUMAN IMPACT AT SKI LIFTS ON SCOTTISH HILLS. Jour. of Applied Ecology 16:753-754. 1979.
Note: new.

193. Whelan, T. ed. NATURE TOURISM: MANAGING FOR THE ENVIRONMENT. Island Press. Washington, D.C. 1991.
Note: new.

194. White, P. S. and S. P. Bratton. AFTER PRESERVATION; PHILOSOPHICAL AND PRACTICAL PROBLEMS OF CHANGE. Biol. Conservation 18:241-255. 1980.
Note: new.
It is not only the recreationist who impacts wildlands, but the scientist, educator, and school group as well.

195. Whittaker, J. SNOWMOBILING OVER FORAGE GRASSES. Paper presented at Conference on Snowmobiles and All-terrain Vehicles at Univ. of Western Ontario, Canada. 1971.
Note: new.

196. Wiens, J. A. SPATIAL SCALING IN ECOLOGY. Functional Ecology 3:385-397. 1989.
Note: new.

197. Wilcox, B. A. and D. D. Murphy. CONSERVATION STRATEGY: THE EFFECTS OF FRAGMENTATION ON EXTINCTION. Am. Nat. 125:879-887.
Note: new.

198. Williams, M. and A. Lester. ANNOTATED BIBLIOGRAPHY OF OHV AND OTHER RECREATIONAL IMPACTS TO WILDLIFE. Eldorado National Forest. USDA Forest Service, Pacific Southwest Region. 10 pp. 1996.
Note: new.

199. Witmer, G. W. and D. S. deCalesta. EFFECT OF FOREST ROADS ON HABITAT USED BY ROOSEVELT ELK. Northwest Science 59(2):122-124. 1985.
Note: new.
Six females monitored for one year. Human activity on forest roads alters distributions of elk habitat use. Impact may be mitigated by road closures, especially during rutting and calving seasons.

200. Young, J. and A. Boyce. RECREATIONAL USES OF SNOW AND ICE IN MICHIGAN AND SOME OF ITS EFFECTS ON WILDLIFE AND PEOPLE. In: Proceedings of the Snow and Ice Symposium. Iowa Coop. Wildl. Res. Unit, Iowa State Univ., Ames. 820 pp. 1971.
Note: new.
Includes skiing.

ADDENDUM

Anonymous. 1992. News and notes. Yellowstone Science, Yellowstone National Park, Wyo. 21 pp.

——— 1996a. Yellowstone Center for Resources 1995 Annual Report, S. Consolo Murphy, M.A. Franke and S. Broadbent, eds., Yellowstone Park, Wyo. 82 pp.

——— 1996b. Investigators' Annual Reports for 1995, B. Lindstrom and S. Broadbent, eds., Yellowstone Park, Wyo. 134 pp.

Barnes, V.G. Jr. and O.E. Bray. 1967. Final report: Population characteristics and activities of black bears in Yellowstone National Park. Colo. Coop. Wildl. Research Unit, Colo. State Univ., Fort Collins. 199 pp.

Beall, R.C. 1974. Winter habitat selection and use by a western Montana elk herd. Ph.D. Thesis. Univ. of Montana, Missoula. 197 pp.

Cole, G.F. 1972. Grizzly bear-elk relationships in Yellowstone National Park. J. Wildl. Manage. 36(2):556-570.

DelGuidice, G., F.J. Singer, U.S. Seal and G. Bowser. 1994. Physiological responses of Yellowstone bison to winter nutritional deprivation. J. Wildl. Manage. 58(1):24-34.

Goodrich, J.M. and J. Berger. 1994. Winter recreation and hibernating black bears Ursus americanus. Biological Conservation 67:105-110.

Green, G.I. 1988. Dynamics of ungulate carcass availability and use by bears on the northern range and Firehole and Gibbon drainages. Yellowstone Grizzly Bear Investigations: Annual Report of the Interagency Bear Study Team, R.R. Knight, B.M. Blanchard and M. Mattson, eds., U.S. National Park Service, Bozeman, Mont.

Mattson, D. J. and J. Henry. 1987. Spring grizzly bear use of ungulate carcasses in the Firehole River drainage: Second Year Progress Report. Pp. 63-72 in Yellowstone Grizzly Bear Investigations: Annual Report of the Interagency Study Team 1986. USDI National Park Service. Bozeman, Mont.

Thurber, J.M., R.O. Peterson, T.D. Drummer, and S.A. Thomasa. 1994. Gray wolf response to refuge boundaries and roads in Alaska. Wildl. Soc. Bull. 22(1):61-68.

Wesley, D.E., K.L. Knox and J.G. Nagy. 1973. Energy metabolism of pronghorn antelope. J. Wildl. Manage. 57:563-573.

Appendix II

SELECTED LITERATURE CITATIONS FROM BENNETT 1995[1] AND NEW CITATIONS FROM CASLICK 1997[2] ON WINTER RECREATION EFFECTS ON WILDLIFE

J. and E. Caslick
Resource Management, YCR
Yellowstone Park, WY 82190

March 1997

[1]Bennett, L.E. 1995. A review of potential effects of winter recreation on wildlife in Grand Teton and Yellowstone National Parks: a bibliographic data base. Univ. of Wyo. Coop. Fish and Wildlife Research Unit, Laramie. 108 pp.

[2]Caslick, J. and E. 1997. New citations on winter recreation effects on wildlife. Resource Management, YCR, Yellowstone Park, Wyo. 22 pp.

1. Aasheim, R. SNOWMOBILE IMPACTS ON THE NATURAL ENVIRONMENT. in: R. N. L. Andrews; and P. F. Nowak, eds. Off-road Vehicle use: A Management Challenge; Conf. Proc., 16-18 March 1980. Ann Arbor, MI. 1980.
Snowmobiling and its impacts on natural environments in Montana are described. Studies of impacts on deer and elk have produced conflicting results, but there is little doubt that additional stress in winter is undesirable. Animals accustomed to humans are less affected by snowmobiles than animals in more remote areas. Effects on small mammals and possible effects of packed snowmobile trails are discussed.
2. Adams, E. S. EFFECTS OF LEAD AND HYDROCARBONS FROM SNOWMOBILE EXHAUST ON BROOK TROUT (*Salvalinus fontinalis*). Trans. Amer. Fish Soc.; 104(2):363-373. 1975.
Field and lab study on fingerling brook trout.
3. Allbrecht, J.; and D. Smith. ENVIRONMENTAL EFFECTS OF OFF-ROAD VEHICLES: A SELECTED BIBLIOGRAPHY OF PUBLICATIONS IN THE UNIVERSITY OF MINNESOTA FORESTRY LIBRARY. Univ. Minnesota, St. Paul Campus Libraries, For. Serv. Libr. Bibligr. Ser. 2. 9 pp. 1977.
*Bibliography.
4. Alldredge, R. B. SOME CAPACITY THEORY FOR PARKS AND RECREATION AREAS. National Park Service Reprint. 1972.
5. Allen, J. N. *THE ECOLOGY AND BEHAVIOR OF THE LONG-BILLED CURLEW IN SOUTHEASTERN WASHINGTON. Wildl. Monogr. 73:1-67. 1980.
6. Allen, R. P. *THE WHOOPING CRANE. National Audubon Society, Rep. 3, New York. 246 pp. 1952.
7. Allendorf, F. W.; and C. Serveen. *GENETICS AND THE CONSERVATION OF GRIZZLY BEARS. Trends in Ecol. and Evol.; 1:88-89. 1986.
8. Alt, K. L. ECOLOGY OF THE BREEDING BALD EAGLE AND OSPREY IN THE GRAND TETON-YELLOWSTONE NATIONAL PARKS COMPLEX. M. S. thesis. Univ. of Montana. 95 pp. 1980.
Note: new.
9. Altman, M. THE FLIGHT DISTANCE IN FREE-RANGING BIG GAME. J. Wildl. Manage.; 22(2):207-209. 1958.
The distance at which free-ranging elk and moose would flee from humans varied with habitat, social groupings, nutrition, reproductive status, and specific experience of individual animals of the group (Ream 1980).
10. Anderson, D. L. A WINDOW TO THE NATURAL WORLD: THE DESIGN OF ECOTOURISM FACILITIES. In Ecotourism: A Guide for Planners and Managers, eds. K. Lindberg and D. E. Hawkins, 116-153. North Bennington, Vermont: The Ecotourism Society. 1993.
Note: new.
Emphasis on design to reduce environmental impacts and enhance visitors' satisfaction and awareness of the environment.

11. Anderson, D. W.; and J. O. Kieth. THE HUMAN INFLUENCE ON SEABIRD NESTING SUCCESS: CONSERVATION IMPLICATIONS. Biol. Conserv.; 18:65-80. 1980. Studies of brown pelicans and Heerman's gulls indicated that disturbances by recreationists, educational groups, and scientists could seriously disrupt seabird breeding on the coast of Baja California. Human disturbances lead to inter- and intra-specific behavioral imbalances in seabirds. Methods for minimizing disturbances are discussed (Boyle and Sampson 1983).

12. Anderson, E. M. *A CRITICAL REVIEW AND ANNOTATED BIBLIOGRAPHY OF LITERATURE ON THE BOBCAT. Colorado Division of Wildlife, Special Report No. 62. 61 pp. 1987.

13. Anderson, S. H. *COMPARATIVE FOOD HABITS IN OREGON NUTHATCHES. Northwest Sci.; 50:213-221. 1976.

14. Anderson, S. H. RECREATIONAL DISTURBANCE AND WILDLIFE POPULATIONS. In R. L. Knight and K. J. Gutzwiller, eds. Wildlife and Recreation: Coexistence Through Management and Research. Island Press. Washington, D.C. 1995.
Note: new.

15. Anthony, A. and E. Ackerman. EFFECTS OF NOISE ON THE BLOOD EOSINOPHIL LEVELS AND ADRENALS OF MICE. Journal of the Acoustical Society of America 27(6):1144-1149. 1955.
Note: new.

16. Anthony, R. G., R. J. Steidl, and K. McGarigal. RECREATION AND BALD EAGLES IN THE PACIFIC NORTHWEST. In: Wildlife and Recreation: Coexistence Through Management and Research, R. L. Knight and K. J. Gutzwiller, eds., pp. 223-241. Island Press, Washington, D.C. 1995.
Note: new.
Human disturbance is most serious for eagles that depend on large fish or mammal carcasses as their major food source.

17. Armstrong, F. H. *NOTES ON SOREX PREBLEI IN WASHINGTON STATE. Murrelet; 38:6. 1957.

18. Aune, K. E. IMPACT OF WINTER RECREATIONISTS ON WILDLIFE IN A PORTION OF YELLOWSTONE NATIONAL PARK, WYOMING. M.S. thesis; Montana State Univ., Bozeman. 111 pp. 1981.
General responses of wildlife to winter recreationists in Yellowstone National Park were attention or alarm, light, and, rarely, aggression. Responses varied with the species involved, nature of the disturbance, and time of season. Winter recreation activities was not a major factor influencing wildlife distributions, movements, or population sizes, although minor displacement of wildlife from areas adjacent to trails was observed. Management recommendations are presented (Boyle and Sampson 1983).

19. Austin, J. E. WINTER ECOLOGY OF CANADA GEESE IN NORTHCENTRAL MISSOURI. Ph.D., University of Missouri, Columbia. 284 pp. 1988.
Canada geese tended to spend more of their time in agricultural habitats where they were more vulnerable to disturbances than in seasonal wetlands in the refuge interior or the water roost sites. Vigilance of waterfowl did not differ by habitat in the hunting season, thus the effects of disturbances by hunters are far-reaching. All use of wetlands in late fall occurred in the refuge interior, which is not hunted. However, in response to gunshots from the hunting zone, geese in the refuge interior often ceased other activities and, at least briefly, became alert or vigilant. Habituation of Canada geese to disturbances in some locations may account for the lower vigilance of geese in pastures in winter. These pastures seemed to be traditionally used by geese and may be considered safe fields. Geese seemed to avoid or leave locations where excessive disturbances restricted feeding and where they did not habituate to disturbances.

20. Bailey, T. N. *FACTORS OF BOBCAT SOCIAL ORGANIZATION AND SOME MANAGEMENT IMPLICATIONS. Pages 984-1000 in: J. A. Chapman and D. Pursley, eds. Proc. Worldwide Furbearer Conf., Frostburg, MD. 1981.

21. Baldwin M. F., and D. H. Stoddard. THE OFF-ROAD VEHICLE AND ENVIRONMENTAL QUALITY. Second edition, the Conservation Foundation; Washington, D.C. 61 pp. plus foldout chart. 1973.
This report updates an earlier edition describing the effects of off-road vehicles, particularly snowmobiles. A section on fish and wildlife reviews literature describing harassment of wildlife, and legal responses to adverse impacts of off-road vehicles on wildlife. Policies for control of environmental impacts are suggested (Boyle and Sampson 1983).

22. Baldwin, F. M. THE OFF-ROAD VEHICLE AND ENVIRONMENTAL QUALITY; A REPORT ON THE SOCIAL AND ENVIRONMENTAL EFFECTS OF OFF-ROAD VEHICLES, PARTICULARLY SNOWMOBILES, WITH SUGGESTED POLICIES FOR THEIR CONTROL. The Conservation Foundation, Washington, D.C. 52 pp. 1970.
Note: new.
Clearly the effective way to protect fish and wildlife is not by restricting hunting or harassment alone, but by banning these vehicles from important habitats (p.25).

23. Baldwin, M. F. and D. H. Stoddard, Jr. THE OFF-ROAD VEHICLE AND ENVIRONMENTAL QUALITY: AN UPDATED REPORT ON THE SOCIAL AND ENVIRONMENTAL EFFECTS OF OFF-ROAD VEHICLES, PARTICULARLY SNOWMOBILES, WITH SUGGESTED POLICIES FOR THEIR CONTROL. 2nd ed. Conservation Foundation. Washington, D.C. 61 pp. 1973.
Note: new.

24. Baldwin, M. F. THE SNOWMOBILE AND ENVIRONMENTAL QUALITY. Living Wilderness; 32(104):14-17. 1968.
Recreational uses of snowmobiles is examined in terms of effects on environmental quality through noise, fumes, and impacts on fish, wildlife and trails. Harassment of wild game, nongame, and predators by snowmobile users is described. Policy recommendations are suggested and discussed (Boyle and Sampson 1983).

25. Banko, W. E. *THE TRUMPETER SWAN. N. Am. Fauna 63, U.S. Fish Wildl. Ser., Washington, D.C. 214 pp. 1960.
26. Basil, J. V.; and T. N. Lonner. VEHICLE RESTRICTIONS INFLUENCE ELK AND HUNTER DISTRIBUTION IN MONTANA. J. Forestry; 77:155-159. 1979.
27. Batcheler, C. L. COMPENSATORY RESPONSES OF ARTIFICIALLY CONTROLLED MAMMAL POPULATIONS. Proc. of the New Zealand Ecol. Soc.; 15:25-30. 1968.
28. Bayfield, N. G. SOME EFFECTS OF WALKING AND SKIING ON VEGETATION AT CAIRNGORM. J. Applied Ecology 7:469-485. 1970.
    Note: new.
29. Bear, G. D.; and G. W. Jones. HISTORY AND DISTRIBUTION OF BIGHORN SHEEP IN COLORADO. Colorado Division of Wildlife, Denver, CO. 232 pp. 1973.
    Available information on the history, distribution, population trends, and ecological factors for bighorn sheep herds in Colorado are summarized. Human influences are discussed for each of the herds; while few quantitative data are available, observations suggest that in many cases, such as camping, hiking, and driving off-road vehicles, influence sheep distributions and activities (Boyle and Sampson 1983).
30. Beier, P. DETERMINING MINIMUM HABITAT AREAS AND HABITAT CORRIDORS FOR COUGARS. Conserv. Biol. 7:94-108. 1993.
    Note: new.
31. Belanger, L.; and J. Berdard. ENERGETIC COST OF MAN-INDUCED DISTURBANCE TO STAGING SNOW GEESE. J. Wildl. Manage.; 54:36-41. 1990.
32. Bell, J. N. WILD ANIMALS ARE WILD. Natl. Wildl.; 1(5):34-36. 1963.
    Problems of human-wildlife interactions in National Parks are described in this popular article. Park visitors unaware of the potential hazards of confrontations with wildlife sometimes create dangerous situations by inappropriate behavior. Park visitors are entitled to wildlife viewing experiences, but must be educated about wildlife behavior and maintain respect for wild animals (Boyle and Sampson 1983).
33. Bennett, L. E. COLORADO GRAY WOLF RECOVERY: A BIOLOGICAL FEASIBILITY STUDY. Univ. Wyo. Coop. Fish Wildl. Res. Unit. Laramie. 318 pp. 1994.
34. Bennett, L. E. A REVIEW OF POTENTIAL EFFECTS OF WINTER RECREATION ON WILDLIFE IN GRAND TETON AND YELLOWSTONE NATIONAL PARKS: A BIBLIOGRAPHIC DATABASE. Final Report. Mimeo. Sponsored by U.S. National Park Service in cooperation with Univ. of Wyoming Cooperative Fish and Wildlife Research Unit, Laramie. 141 pp. 1995.
    Note: new.
35. Berry, K. H. A REVIEW OF THE EFFECTS OF OFF-ROAD VEHICLES ON BIRDS AND OTHER VERTEBRATES. In: Management of Western Forests and Grasslands for Nongame Birds. Workshop Proceedings. U.S. For. Srv., Gen. Tech. Rep. INT-86, pp. 451-467. 1980.
    Note: new.

36. Berwick, S. H. OBSERVATIONS ON THE DECLINE OF THE ROCK CREEK, MONTANA, POPULATION OF BIGHORN SHEEP. M.S. thesis; Univ. of Montana, Missoula. 245 pp. 1968.
Among factors that may be responsible for an observed decline in a Montana bighorn sheep population are human disturbance and harassment of sheep. Snowmobile use of an important segment of sheep winter range is increasing. It is suggested that harassment may be debilitating to winter-stressed animals (Boyle and Sampson 1983).
37. Bess, F. H. THE EFFECT OF SNOWMOBILE NOISE ON THE HEARING MECHANISM. Proceedings of the 1971 Snowmobile and Off-Road Vehicle Research Symposium. Sponsored by the Dept. of Park and Recreation Resources, Michigan State University, East Lansing. 1971.
Note: new.
38. Bird, D. M. BIRDS OF PREY: A PLEA FOR ETHICS. Ont. Nat.; 17(5):16-23. 1978.
Problems facing birds of prey are described in this nontechnical article. Effects of man on raptors are discussed, including impacts on research, wildlife photography, and bird watching. Disturbances of birds by these activities can cause adults to abandon nests, and decrease survival of eggs and young through predation or exposure. Education of public on the values of birds of prey is essential for their protection (Boyle and Sampson 1983).
39. Bissell, L. P. THE SOCIAL AND POLITICAL IMPACT OF SNOWMOBILES. In: Proceedings 3rd International Snowmobile Congress, Portland, Maine. pp.58-62. 1970.
Note: new.
40. Bjarvall, A. NORTH AMERICAN STUDIES ON THE EFFECTS OF SNOWMOBILES ON FAUNA. Flora Fauna. 1974.
Note: new.
41. Blackford, J. L. *WOODPECKER CONCENTRATION IN BURNED FOREST. Condor; 57:28-30. 1955.
42. Blangley, S. and M. E. Wood. DEVELOPING AND IMPLEMENTING ECOTOURISM GUIDELINES FOR WILDLANDS AND NEIGHBORING COMMUNITIES. In: Ecotourism: A Guide for Planners and Managers, K. Lindberg and D. E. Hawkins, eds., pp. 32-54. North Bennington, Vermont; The Ecoturism Society. 1993.
Note: new.
43. Blokpoel, H. AN ATTEMPT TO EVALAUTE THE IMPACT OF CANNON-NETTING IN CASPIAN TERN COLONIES. Colon. Waterbirds; 4:61-67. 1981.
From studies of Caspian terns on Lake Huron, Ontario, it was found that visits to tern colonies resulted in losses of eggs to predation by gulls. Human activities at tern nesting colonies should be restricted until more is known about the nature and extent of human-induced nest losses (Boyle and Sampson 1983).
44. Bock, C. E., and J. H. Bock. *ON THE GEOGRAPHICAL ECOLOGY AND EVOLUTION OF THE THREE-TOED WOODPECKERS. Am. Midl. Nat.; 92:397-405. 1974.
45. Bollinger, J. G., O. J. Rongstad, A. Soom, and R. G. Eckstein. SNOWMOBILE NOISE EFFECTS ON WILDLIFE. 1972-1973 report. Engineering Exp. Sta., Univ. of Wisconsin, Madison. 85pp. 1973.
Note: new.

46. Boucher, J., and T. A. Tattar. SNOWMOBILE IMPACT ON VEGETATION. Forest Notes 120:27-28. 1974.
Note: new.
47. Bowles, A. E. RESPONSES OF WILDLIFE TO NOISE. In: Wildlife and Recreation: Coexistence Through Management and Research, R. L. Knight and K. J. Gutzwiller, eds., pp. 109-156. Island Press, Washington, D.C. 1995.
Note: new.
48. Bowles, A., B. Tabachnick, and S. Fidell, eds. REVIEW OF THE EFFECTS OF AIRCRAFT OVERFLIGHTS ON WILDLIFE. National Park Service, Report No. 7500. 373 pp. 1991.
Note: new.
This three-volume compilation, with bibliography, reviews various studies conducted on the effects of aircraft noise on wildlife. A summary draws conclusions. Includes general disturbance factors.
49. Boyce, M. S. POPULATION VIABILITY ANALYSIS. Annu. Rev. Ecol. Syst. 23:481-506. 1992.
Note: new.
50. Boyce, M. S.; and L. D. Hayden-Wing. *NORTH AMERICAN ELK: ECOLOGY, BEHAVIOR AND MANAGEMENT. Univ. Wyo., Laramie. 294 pp. 1971.
51. Boyd, R. J. *AMERICAN ELK. Pages 10-29 in: J. D. Schmidt and D. L. Gilbert, eds. Big game of North America. Stackpole Books, Harrisburg, PA., and Wildl. Manage. Inst., Washington, D.C. 1978.
52. Boyle, S. A. and F. B. Samson. EFFECTS OF NONCONSUMPTIVE RECREATION ON WILDLIFE: A REVIEW. Wildlife Society Bull. 13(2):110-116. 1985.
Note: new.
A literature review of 536 references which showed negative effects for most types of recreational activity. Suggests four management alternatives including “sacrifice” areas.
53. Boyle, S. A. and F. B. Samson. EFFECTS OF NONCONSUMPTIVE RECREATION ON WILDLIFE: A REVIEW. Wildl. Soc. Bull. 13:110-116. 1985.
Note: new.
54. Boyle, S. A.; and F. B. Samson. NONCONSUMPTIVE OUTDOOR RECREATION: AN ANNOTATED BIBLIOGRAPHY OF HUMAN -WILDLIFE INTERACTIONS. USDI, U.S. Fish Wildl. Serv. Special Sci. Rep. No. 252. 1983.
*Annotated Bibliography.
55. Brand, C. J.; L. B. Keith; and C. A. Fischer. *LYNX RESPONSES TO CHANGING SNOWSHOE HARE DENSITIES IN CENTRAL ALBERTA. J. Wildl. Manage.; 40:416-428. 1976.
56. Budowski, G. TOURISM AND ENVIRONMENTAL CONSERVATION: CONFLICT, COEXISTENCE, OR SYMBIOSIS? Environ. Conserv.; 3:27-31. 1976.
Relationships between tourism and conservation are described as conflicting, coexisting, or symbiotic. Widespread environmental degradation has often resulted from tourism, as many places visited by tourists support fragile ecosystems. Proper attitudes and management schemes can lead to symbiotic relationships instead of conflicts (Boyle ans Sampson 1983).

57. Buehler, D. A.; T. J. Mersmann; J. D. Fraser; and J. K. D. Seegar. EFFECTS OF HUMAN ACTIVITY ON BALD EAGLE DISTRIBUTION ON THE NORTHERN CHESAPEAKE BAY. J, Wildl. Manage.; 55:282-290. 1991.

58. Buehler, D. A.; T. J. Mersmann; J. D. Fraser; and J. D. Seegar. NONBREEDING BALD EAGLE COMMUNAL AND SOLITARY ROSSTING BEHAVIOR AND ROOST HABITAT ON THE NORTHERN CHESAPEAKE BAY. J. Wildl. Manage. 55(2):273-281. 1990.

The authors studied roosting behavior and habitat use of nonbreeding bald eagles on the northern Chesapeake Bay during 1986-1989. Results of the study included the recommendation that a 1,360-m-wide shoreline management zone that extends 1,400 m inland should be provided to encompass roost sites and provide a buffer from human disturbance.

59. Buell, N. E. REFUGE RECREATION: HIGH STANDARDS EQUAL QUALITY. Living Wilderness; 31(98):24-26. 1967.

The role of U.S. National Wildlife Refuges in providing recreational opportunities is discussed in this popular article. Planning for recreation on refuges is based on the view that quality of experience rather than quantity of use is most desirable to visitors and protected wildlife. Responsibilities and approaches to recreation management are discussed (Boyle and Samson 1983).

60. Bull, E. L. *ECOLOGY OF THE PILEATED WOODPECKER IN NORTHEASTERN OREGON. J. Wildl. Manage.; 51(2):472-481. 1987.

61. Bull, E. L.; and M. G. Henjum. *THE NEIGHBORLY GREAT GRAY OWL. Natural History; 9:32-41. 1987.

62. Burger, J. THE EFFECT OF HUMAN ACTIVITY ON SHOREBIRDS IN TWO COASTAL BAYS IN NORTHEASTERN UNITED STATES. Environ. Conserv.; 13:123. 1986.

63. Burger, J. FORAGING BEHAVIOR AND THE EFFECTS OF HUMAN DISTURBANCE ON THE PIPING PLOVER. J. Coast. Res.; 7:39-52. 1991.

64. Burk, D. ed. *THE BLACK BEAR IN MODERN NORTH AMERICA. Proc. of the workshop on the management biology of the North American black bear, Kalispell, MT., 17-19 Feb 1977. Boone and Crockett Club, New York, and Amwell Press, Clinton, N.J. 300 pp. 1979.

65. Burkey, T. V. EXTINCTION IN NATURE RESERVES: THE EFFECT OF FRAGMENTATION AND THE IMPORTANCE OF MIGRATION BETWEEN RESERVE FRAGMENTS. Oikos 55:75-81. 1989.

Note: new.

66. Bury, R. EFFECTS OF OFF-ROAD VEHICLES ON DESERT VERTEBRATES. Bulletin of the Ecological Society of America 56(2):40. 1975.

Note: new.

67. Bury, R. B., R. A. Luckenbach, and S. D. Busak. EFFECTS OF OFF-ROAD VEHICLES ON VERTEBRATES IN CALIFORNIA. USDI Fish & Wildlife Service. 1977.
Note: new.
Compared 8 paired sites. ORV use areas had significantly fewer species of vertebrates, reduced numbers of individuals and lower reptile and small mammal biomass. Censuses also showed decreased diversity, density, and biomass estimates of breeding birds in ORV used areas.

68. Bury, R. L. IMPACTS OF SNOWMOBILES ON WILDLIFE. Trans. N. Am. Wildl. Nat. Resour. Conf.; 43:149-156. 1978.
Existing research on snowmobile-wildlife interactions and future research needs are discussed (Boyle and Sampson 1983).

69. Bury, R. L. OFF-ROAD RECREATION VEHICLES: RESEARCH RESULTS AND ADMINISTRATIVE REPORTS, AND TECHNICAL ARTICLES, 1970-1975. Council of Planning Librarians, Monticello, Ill., Exch Biblio. 1067. 23 pp. 1976.
*Bibliography.

70. Bury, R. B. WHAT WE KNOW AND DO NOT KNOW ABOUT OFF-ROAD VEHICLE IMPACTS ON WILDLIFE. Page 110-122 in: R. N. L. Andrews; and P. F. Nowak, eds. Off-road vehicle use: A management challenge. Conf. Proc., 16-18 March 1980, Ann Arbor, MI. 1980.
Research concerning off-road vehicle impacts on wildlife is reviewed to illustrate the levels of impacts and to provide guidance for more effective protection of wildlife in off-road vehicle areas. Effects on wildlife include direct mortality, damage to vegetation, disruption of soil, and noise harassment. Research and management recommendations are suggested (Boyle and Sampson 1983).

71. Bury, R. L.; S. F. McCool; and R. J. Wendling. RESEARCH ON OFF-ROAD VEHICLES: A SUMMARY OF SELECTED REPORTS AND A COMPREHENSIVE BIBLIOGRAPHY. Pages 234-272, in: Proc. of the Southern States Recreation Research Applications Workshop, 15-18 September 1975, Asheville, NC. U.S. For, Serv. Gen. Tech. Rep. SE-9. 1976.
Bibliography.

72. Busnel, R. G. EFFECTS OF NOISE ON WILDLIFE: INTRODUCTION. Pages 7-22 in: J. L. Fletcher and R. G. Busnel. 1978.
This introductory article reviews some aspects of animal behavior associated with noise, citing examples from scientific literature and anecdotal observations. Theoretical approaches and aspects of policy relating to noise effects and the conservation of wildlife are discussed (Boyle and Sampson 1983).

73. Buss, I. O.; and A. S. Hawkins. *THE UPLAND PLOVER AT FAVILLE GROVE, WISCONSIN. Wilson Bull.; 51:202-220. 1939.

74. Butcher, D. SNOWMOBILES AND THE NATIONAL PARKS. Am For.; 78(4):28-31, 46-49. 1972.
The author cites Congressional testimony, popular literature, and personal experiences to document environmental impacts of snowmobiles, including impacts on wildlife. Habitat destruction and deliberate harassment of animals are noted. The author calls for the prohibition of snowmobiles and other off-road vehicles in National Parks to protect the environment and ensure the satisfaction of other park visitors (Boyle and Sampson 1983).

75. Cade, T. J.; J. H. Enderson; C. G. Thelander; and C. M. White. *PEREGRINE FALCON POPULATIONS: THEIR MANAGEMENT AND RECOVERY. The Peregrine Fund, Inc., Boise. 949 pp. 1988.

76. Call, M. W. HABITAT MANAGEMENT FOR BIRDS OF PREY. U.S.D.I; Bureau of Land Management, Tech. Note 338. 70pp. 1979.
Habitat management considerations for birds of prey are reviewed. Human activities that should be controlled in nesting and roosting areas include recreational activities; many areas preferred by humans for recreation are important raptor nesting sites as well. Management considerations include siting recreational developments away from important raptor habitats, and restricting human activities during the breeding season (Boyle and Sampson 1983).

77. Cannon, H. L. and J. M. Bowles. CONTAMINATION OF VEGETATION BY TETRAETHYL LEAD. Science 137:765-766. 1988.
Note: new.

78. Carbyn, L. N. WOLF POPULATION FLUCTUATIONS IN JASPER NATIONAL PARK, ALBERTA, CANADA. Biol. Consev.; 6(2):94-101. 1974.
Population fluctuations mainly a result of human pressures in areas adjacent to park. Population negatively affected by disturbance at den site and high percentage of ungulates on heavily traveled roads as wolves tend to avoid traveled roads.

79. Carbyn, L. N. *WOLF PREDATION OF ELK IN RIDING NATIONAL PARK, MANITOBA. J. Wildl. Manage.; 47(4):977-988. 1983.

80. Casey, D. *AMERICAN MARTEN. Dodd-Mead, New York. 64 pp. 1988.

81. Cassirer, E. F. RESPONSES OF ELK TO DISTURBANCE BY CROSS-COUNTRY SKIERS IN NORTHERN YELLOWSTONE NATIONAL PARK. M. S. Thesis, Univ. of Idaho, Moscow. 101 pp. 1990.
Note: new.

82. Cassirer, E. F.; D. J. Freddy; and E. D. Ables. ELK RESPONSES TO DISTURBANCE BY CROSS-COUNTRY SKIERS IN YELLOWSTONE NATIONAL PARK. Wildl. Soc. Bull.; 20:375-381. 1992.
The objectives of this study were to measure the immediate movements of elk when disturbed by cross-country skiers, to assess energy costs associated with these movements, and to identify factors that might influence elk behavior. The results of this disturbance study indicate that restricting cross-country skiers to locations > 650 m from elk wintering areas would probably minimize displacement of most nonhabituated elk by skiers on shrub steppe and upland steppe winter ranges similar to that in Yellowstone. Seventy-five percent of nonhabituated elk flight responses in northern Yellowstone occurred within 650 m. Skiers would likely have to remain at distances of >1,700 m to completely avoid disturbing elk. The amount of winter range used by skiers and the number of days involved seemed to be more important than skier numbers.

83. Chapman, R. C. THE EFFECTS OF HUMAN DISTURBANCE ON WOLVES. M.S. thesis; Univ. Alaska, Fairbanks 209 pp. 1977.
Wolves responded to humans near pups by barking or howling, leaving the area, or moving the pups. Low intensity disturbance does not seem to cause significant pup mortality. Recommends closing areas of 2.4 km radius around homesites to disturbance from 4 or 5 weeks before whelping until wolves leave the area. Contains appendix of more than 100 published and unpublished accounts of wolf/man interactions (Ream 1980).

84. Chappel, R. W. and R. J. Hudson. PREDICTION OF ENERGY EXPENDITURES BY ROCKY MOUNTAIN BIGHORN SHEEP. Can. J. Zool. 58:1908-1912. 1980.
Note: new.

85. Chester, J. M. HUMAN WILDLIFE INTERACTIONS IN THE GALLATIN RANGE, YELLOWSTONE NATIONAL PARK, 1973-1974. M.S. thesis; Montana State Univ., Bozeman. 114 pp. 1976.
Relationships between human use and the distribution, movements, and behavior of seven species of wildlife in the backcountry of the Gallatin Range, Yellowstone National Park, were investigated. Variation in the intensity of human use was rarely responsible for shifts in wildlife distribution. Wildlife belligerency towards humans was rare, although backcountry travelers tended to engage in activities that could increase detrimental encounters with wildlife (Boyle and Samson 1983).

86. Clark, T. W. *ANALYSIS OF PINE MARTEN POPULATION ORGANIZATION AND REGULATORY MECHANISMS IN JACKSON HOLE, WYOMING. Nat. Geogr. Soc. Research Report; 1982:131-143. 1982.

87. Clark, T. W.; E. Anderson; C. Douglas; and M. Strickland. *MARTES AMERICANA. Mammalian Species No. 289:1-8. 1987.

88. Clark, T. W.; A. H. Harvey, R. D. Dorn; D. L. Genter; and C. Groves, eds. RARE, SENSITIVE, AND THREATENED SPECIES OF THE GREATER YELLOWSTONE ECOSYSTEM. Northern Rockies Conservation Cooperative, Montana Natural Heritage Program, The Nature Conservancy, and Mountain West Environmental Services. 153 pp. 1989.
This report gives a description, range, habitat, life history and ecology, and conservation needs of each rare, sensitive, and threatened species (animal and plant) associated with the Greater Yellowstone Ecosystem (GYE).

89. Clark, T.; M. Bekoff; T. M. Campbell; and T. Hauptman. AMERICAN MARTEN, MARTES AMERICANA, HOME RANGES IN GRAND TETON NATIONAL PARK, WYOMING. Canadian Field-Nat.; 103(3):423-425. 1988.

90. Clevenger, G. A.; and G. W. Workman. THE EFFECTS OF CAMPGROUNDS ON SMALL MAMMALS IN CANYONLANDS AND ARCHES NATIONAL PARKS, UTAH. Trans. N. Am. Wildl. Nat. Resour. Conf.; 42:473-484. 1977.
Small mammal studies in 2 National Parks in Utah indicated that campgrounds may have significant effects on populations of small mammals inhabiting them. Additional food available at campgrounds may be partly responsible for larger populations observed in campgrounds (Boyle and Samson 1983).

91. Cole, D. N. and P. B. Landres. INDIRECT EFFECTS OF RECREATIONISTS ON WILDLIFE. In: Wildlife and Recreation: Coexistence Through Management and Research, R. L. Knight and K. J. Gutzwiller, eds., pp. 183-202. Island Press, Washington, D.C. 1995.
Note: new.
92. Cole, D. L. and R. L. Knight. WILDLIFE PRESERVATION AND RECREATIONAL USE: CONFLICTING GOALS OF WILDLIFE MANAGEMENT. Tran. N. Am. Wildl. Nat. Res. Conf. 56:233-237. 1991.
Note: new.
93. Cole, David N. WILDERNESS RECREATION MANAGEMENT. J. For.; 91(2):224. 1993.
94. Cole, David L. WILDLIFE PRESERVATION AND RECREATIONAL USE:CONFLICTING GOALS OF WILDLIFE MANAGEMENT. Trans. N. Am. Wildl. Nat. Resour. Conf.; No. 5 p. 233-237. 1991.
95. Cole, G. F. GRIZZLY BEAR–ELK RELATIONSHIPS IN YELLOWSTONE NATIONAL PARK. J. Wildl. Mgmt. 36(2):556-561. 1972.
Note: new.
96. Connolly, G. E. *LIMITING FACTORS AND POPULATION REGULATION. Pages 245-285 in: O. A. Wallmo, ed. Mule and Black-tailed deer of North America. Univ. Neb. Press, Lincoln. 1981.
97. Connolly, G. E.; and D. C. Wallmo. *MANAGEMENT CHALLENGES AND OPPORTUNITIES. Pages 537-545 in: O. C. Wallmo, ed. Mule and black-tailed deer of North America. Univ. Neb. Press, Lincoln. 1981.
98. Conrad, A. H. WILDERNESS PRESERVATION, PLANNING AND MANAGEMENT: AN ANNOTATED BIBLIOGRAPHY. Council of Planning Librarians, Monticello, Ill., Exch. Biblio. 1515. 54 pp. 1978.
*Annotated Bibliography.
99. Cooke, A. S. OBSERVATIONS ON HOW CLOSE CERTAIN PASSERINE SPECIES WILL TOLERATE AN APPROACHING HUMAN IN RURAL AND SUBURBAN AREAS. Biological Conservation 18:85. 1980.
Note: new.
100. Corbet, P. S. SNOWMOBILES: FOR PLEASURE, PROFIT, AND POLLUTION. Ont. Nat.; 8(2):10-12. 1970.
Impacts of snowmobiles on urban and rural environments, including effects on wildlife, are discussed in this nontechnical article. Snowmobiles compact snow, changing the physical and thermal properties and thus potentially affecting animals that live beneath snow in winter. Deliberate harassment of wildlife by snowmobilers is uncommon but may be significant. Effective legislation and enforcement are needed to control the impacts of snowmobiles on the environment (Boyle and Samson 1983).
101. Corbus, M. MOOSE AS AN AESTHETIC RESOURCE AND THEIR SUMMER FEEDING BEHAVIOR. Am. Moose Conf. Workshop 8:244-273. 1972.
A moose herd in Sibley Provincial Park, Ontario, is described as an appreciative resource used by many campers who go there specifically to view moose. Responses of moose to the presence of humans and aspects of the resource users are discussed (Boyle and Samson 1983).

102. Craig, G. *PEREGRINE FALCON. Pages 807-826 in: Audubon Wildlife Report 1986. The National Audubon Society, Washington, D.C. 1986.

103. Craighead, F. C., Jr; and J. J. Craighead. DATA ON GRIZZLY BEAR DENNING ACTIVITIES AND BEHAVIOR OBTAINED BY WILDLIFE TELEMETRY. Pages 84-106 in: S. Herrero, ed. Bears—their biology and management, 6-9 November 1970, Calgary, Alberta. IUCN Publ. New Ser. 23, Morges, Switzerland. 1972.
Denning behavior of telemetered grizzly bears was studied in Yellowstone National Park. Observations suggested that grizzlies do not actively defend dens from other bears or humans if alternate courses of action are available. Most grizzlies apparently prefer to avoid humans; the most dangerous bears are those that have been wounded, sows with cubs, and those that have learned to associate food with humans (Boyle and Samson 1983).

104. Craighead, J. J., G. Atwell and B. W. O'Gara. ELK MIGRATIONS IN AND NEAR YELLOWSTONE NATIONAL PARK. Wildl. Monog. 29. 48 pp. 1972.
Note: new.

105. Craighead, J. J.; and F. C. Craighead, Jr. GRIZZLY BEAR-MAN RELATIONSHIPS IN YELLOWSTONE NATIONAL PARK. BioScience; 21:845-857. 1971.
Results are reported of 12 years of research on grizzly bears and their relationships with man in Yellowstone National Park and surrounding national forests. The chance for injury from grizzly bears is very small, but grizzly attacks provide exciting news and generate an exaggerated public response, which in turn may initiate over-reactionary bear control measures harmful to bear-human coexistence. Management must be carefully tailored to the facts of bear behavior, while visitors must be willing to accept a small risk (Boyle and Samson 1983).

106. Craighead, J. J.; J. R. Varney; and F. C. Craighead. *A POPULATION ANALYSIS OF THE YELLOWSTONE GRIZZLY BEARS. Mt. For. Cons. Exp. Sta. Bull.; No 40. 40 pp. 1974.

107. Cryer, M.; R. M. Ward; J. O. Stafford; and P. F. Randerson. DISTURBANCE OF OVERWINTERING WILDFOWL BY ANGLERS AT TWO RESEVOIR SITES IN SOUTH WALES. Bird Study; 34:191-199. 1987.

108. Curtis, S. HOW TO TRACK WILDLIFE ON SKIS. Backpacker 2(4):40-45, 79-80, 83. 1974.
Recommends techniques for approaching wildlife in winter for observation and photography. Warns of negative effects of disturbance on wintering wildlife. Cites snowmobile harassment of ungulates (Ream 1980).

109. Dahlgren, R. B.; and C. E. Korschgen. HUMAN DISTURBANCES OF WATERFOWL. USDI, U.S. Fish Wildl. Serv. Res. Pub. 188. 62 pp. 1992.
Annotated Bibliography.

110. Dalle-Molle, J.; and J. Van Horn. OBSERVATION OF VEHICLE TRAFFIC INTERFERING WITH MIGRATION OF DALL'S SHEEP, OVIS DALLI DALLI, IN DENALI NATIONAL PARK, ALASKA. Canadian Field-Nat.; 105(3):409-411.
Two observations of Dall's sheep groups unsuccessfully attempting to cross the Denali National Park Road, during a seasonal migration, are described. Where the road passes through sheep range, sheep have habituated to the traffic and readily cross. Sheep occupying ranges away from the road must cross the road during seasonal migrations and have not habituated to traffic, even though the road has been there for 54 years.

111. Daon, K. H. EFFECT OF SNOWMOBILES ON FISH AND WILDLIFE RESOURCES. Conv. Int. Assoc. Game Fish Conserv. Comm.; 60:97-103. 1970.
Increases in demand for snowmobiles and potential impacts on fish and wildlife resources are reviewed. Impacts of snowmobiles are listed as benefits and liabilities; other sections discuss registration, regulation, and education of snowmobile users (Boyle and Samson 1983).

112. Davy, B. A. and B. H. Sharp. CONTROL OF SNOWMOBILE NOISE. Environmental Protection Agency, Ofc. of Noise Abatement and Control. Springfield, VA. 1984.
Note: new.

113. DeForge, J. R. STRESS: IS IT LIMITING BIGHORN? Trans. Desert Bighorn Council; 20:30-31. 1976.
The bighorn sheep is an ice-age mammal that has become highly specialized, evolving essentially outside the influence of man. Today, however, human encroachment on sheep habitats and disturbance of populations result in stress in bighorns, forcing them to adapt socially. Stress, frequently human-induced, appears to be a major limiting factor in the bighorn's struggle for survival (Boyle and Samson 1983).

114. deGroot, R. W. TOURISM AND CONSERVATION IN THE GALAPAGOS. Biological Conservation 26:291-300. 1983.
Note: new.

115. Delgiudice, G. D.; F. J. Singer; and U. S. Seal. PHYSIOLOGICAL ASSESSMENT OF WINTER NUTRITIONAL DEPRIVATION IN ELK OF YELLOWSTONE NATIONAL PARK. J. Wildl. Manage.; 55(4):653-664. 1991.
During 13 January-29 March 1988, the authors assessed the extent of nutritional deprivation in cow elk groups on the lower, middle, and upper Northern Range and on the Madison-Firehole Range in Yellowstone National Park by 4 sequential collections and chemical analyses of urine excreted in snow (snow-urine). Throughout winter, snow-urine samples with metabolic profiles indicative of severe energy deprivation and accelerated degradation of lean body tissue were most apparent in areas associated with increased elk density and/or deep snow cover.

116. DeMarchi, R. REPORT AND RECOMMENDATIONS OF THE WORKSHOP ON CALIFORNIA BIGHORN SHEEP. Pages 143-163 in: J. B. Trefethen ed. The wild sheep in modern North America. Boone and Crockett Club and the Winchester Press, NY. 1975.
Objectives and procedures for management of California bighorn sheep for consumptive and nonconsumptive uses are described. Protection of bighorn sheep includes regulating off-road vehicles and human activities such as hiking, camping. picknicking, and sightseeing. Noncosumptive recreational uses of bighorn sheep are recognized as valuable and important criteria (Boyles and Samson 1983).

117. Denniston, R. H. ECOLOGY, BEHAVIOR AND POPULATION DYNAMICS OF THE WYOMING OR ROCKY MOUNTAIN MOOSE. Zoologica (NY); 41:105-118. 1956.
This report of ecological studies of moose in Wyoming includes sections on man-moose interactions. Moose were found to be tolerant of close observers when no quick motions or loud noises were made. Cases of moose aggression toward people and automobiles are noted (Boyle and Samson 1983).

118. Despain, D. D. Houston, M. Meagher, and P. Schullery. WILDLIFE IN TRANSITION: MAN AND NATURE ON YELLOWSTONE'S NORTHERN RANGE. Roberts Rinehart. Boulder, Colo. 142 pp. 1986.
Note: new.

119. Dice, E. F. EFFECTS OF SNOWMOBILING ON ALFALFA, TREES (PINUS RESINOSA, PINUS BANKSIANA) AND SOIL BACTERIA. Ext. Bull. Michigan State Coop. Ext. Serv. East Lansing, Mich. 1976.
Note: new.

120. Diem, K. L. WHITE PELICAN REPRODUCTIVE FAILURES IN THE MOLLY ISLANDS BREEDING COLONY IN YELLOWSTONE NATIONAL PARK. In: R. M. Linn, ed. Proc. of the 1st Conf. on Sci. Res. in the Nat. Parks. National Park Serv. Trans. and Proc. Series No. 5:489-496. 1979.

121. Diem, K. L.; and D. D. Condon. BANDING STUDIES OF WATERBIRDS ON THE MOLLY ISLANDS, YELLOWSTONE LAKE, WYOMING. Yellowstone Library and Museum Assoc., Yellowstone National Park, WY. 41 pp. 1967.

122. Dixon, K. R. and J. A. Chapman. HARMONIC MEAN MEASURE OF ANIMAL ACTIVITY AREAS. Ecology 6:1040-1044. 1980.
Note: new.

123. Doan, K. H. EFFECT OF SNOWMOBILES ON FISH AND WILDLIFE RESOURCES. Int. Assoc. Game Fish Conservation Commissioners Convention 60:97-103. New York. 1970.
Note: new.

124. Dorrance, M. J.; P. J. Savage; and D. E. Huff. EFFECTS OF SNOWMOBILES ON WHITE-TAILED DEER. J. Wildl. Manage.; 39(3):563-569. 1975.
In studies of white-tailed deer in Minnesota, deer responded to very low intensities of intrusion by man and snowmobiles. Displacement of deer from areas along trails occurred; in some cases changes in home range size and increased movement were observed. It is suggested that the observed disturbances could be detrimental to deer, especially during severe winters.

125. Douglas, C. W.; and M. A. Strickland. *FISHER. Pages 511-529 in: M. Novak, J. A. Baker, M. E. Obbard. and B. Malloch, eds. Wild furbearer management and conservation in North America. Ministry of Natural Resources, Ontario. 1987.

126. Drewien, R. C. *THE SANDHILL CRANE IN WYOMING. Wyoming Wildl.; 37(7):20-25. 1973.

127. Drewien, R. C.; and E. G. Bizeau. *STATUS AND DISTRIBUTION OF THE GREATER SANDHILL CRANE IN THE ROCKY MOUNTAINS. J. Wildl. Manage.; 38:720-742. 1974.

128. Drewien, R. C.; W. M. Brown; and J. D. Varley. THE GREATER SANDHILL CRANE IN YELLOWSTONE NATIONAL PARK: A PRELIMINARY SURVEY. Pages 27-38 in: J. C. Lewis and J. W. Ziewitz, eds. Proc. 1985 Crane Workshop. Platte River Whooping Crane Maintenance Trust and U.S, Fish and Wildlife Service, Grand Island, NE. 1987.

129. Driver, B. L. and P. J. Brown. THE OPPORTUNITY SPECTRUM CONCEPT AND BEHAVIORAL INFORMATION IN OUTDOOR RECREATION SUPPLY INVENTORIES: A RATIONALE. In: Integrated Inventories and Renewable Natural Resources. Proceedings of the Workshop, eds. Lund, H.G. et al., 24-31. General Tech. Report RM-55. Fort Collins, Colo. U.D. Dept. Agric., Forest. 1978.
Note: new.

130. Dufour, P. EFFECTS OF NOISE ON WILDLIFE AND OTHER ANIMALS. Memphis State University, for United States Environmental Protection Agency, NTID 300.5. 1971.
Note: new.
Data for domestic and laboratory animals was extrapolated for wildlife. Potential impacts included masking of signals and calls. Chronic exposure could result in physiological and behavioral changes. Effects would most likely be cumulative.

131. Dunaway, D. J. HUMAN DISTURBANCE AS A LIMITING FACTOR OF SIERRA NEVADA BIGHORN SHEEP. Trans. N. Am. Wild Sheep Conf.; 1:165-173. 1971.
Disturbance caused by human recreation is suggested as a factor limiting populations of bighorn sheep in California. Three populations that have declined were in areas of increased recreational use; two other stable populations have suffered less disturbance by recreationists (Boyle and Samson 1983).

132. Dunning, J. B., B. J. Danielson, and H. R. Pulliam. ECOLOGICAL PROCESSES THAT AFFECT POPULATIONS IN COMPLEX LANDSCAPES. Oikos 65:169-175. 1992.
Note: new.

133. Dunstan, T. C. THE BIOLOGY OF OSPREYS IN MINNESOTA. Loon; 45:108-113. 1973.
Results of 10 years of osprey research are summarized. While the effects of human disturbance to osprey productivity are difficult to evaluate, observations suggest that ospreys are sensitive to human interference, especially during incubation. Some nest abandonments have followed increased summer recreational use of the areas by boaters and fishermen (Boyle and Samson 1983).

134. Dunstan, T. C. BREEDING SUCCESS OF OSPREY IN MINNESOTA FROM 1963 TO 1968. Loon; 40:109-112. 1968.
The author reports results of his own studies plus observations gathered from several sources concerning osprey breeding success in Minnesota. Records indicate that human disturbance is a significant factor in reducing osprey productivity. Disturbances by direct shooting and by chilling or overheating of eggs when adults are frightened from nests are recorded (Boyle and Samson 1983).

135. Eckstein, R. G. and O. J. Rongstad. EFFECTS OF SNOWMOBILES ON THE MOVEMENTS OF WHITE-TAILED DEER IN NORTHERN WISCONSIN. Proc. Midwest Fish and Wildl. Conf. 35-39. 1973.
Note: new.

136. Eckstein, R. G.; T. F. O'Brien; O. J. Rongstad; and J. G. Bollinger. SNOWMOBILE EFFECTS ON MOVEMENTS OF WHITE-TAILED DEER: A CASE-STUDY. Environ. Conserv.; 6:45-51. 1979.

Effects of snowmobiles on winter home ranges, movements, and activity patterns of white-tailed deer were studied in Wisconsin. Daily activity patterns, home range size, and habitat use were little affected by snowmobiles. the impact of snowmobiles on deer appears to be minimal, but routing trails away from deer concentration areas in winter is suggested (Boyle and Samson 1983).

137. Edge, W. D.; and C. L. Marcum. MOVEMENTS OF ELK IN RELATION TO LOGGING DISTURBANCES. J. Wildl. Manage.; 49(4):926-930. 1985.

The objective of this study was to quantify the home ranges of nonmigratory cow elk, and to assess the effect of logging activities on home-range fidelity in the Chamerlain Creek area about 56 km east of Missoula, Montana. Results of the study indicate that cow elk will not abandon traditional home ranges because of logging activity when extensive areas of cover remain within their home range. Disturbances may alter habitat selection by increasing use of areas that provide cover, but this will occur within the traditional home range. In areas where cover is limited, logging activity may increase home-range size and reduce home-range fidelity. If closed areas are provided adjacent to all sides of active logging sales, disturbed home ranges will more likely contain security zones for elk. Logging activities that are restricted as much as possible in time and space, or conducted on seasonal ranges during when the elk are not present, will be least disruptive.

138. Edge, W. D.; C. L. Marcum; and S. L. Olson. EFFECTS OF LOGGING ACTIVITIES ON HOME-RANGE FIDELITY OF ELK. J. Wildl. Manage.; 49(3):741-744. 1985.

139. Edington, J. M.; and A. M. Edington. ECOLOGY, RECREATION AND TOURISM. Cambridge Univ. Press, Cambridge. 200 pp. 1986.

140. Elder, J. M. HUMAN INTERACTIONS WITH SIERRA NEVADA BIGHORN SHEEP: THE MOUNT BAXTER HERD. M.S. thesis; Univ. of Michigan, Ann Arbor. 93 pp. 1977.

A project begun in 1976 studied human disturbance of bighorn sheep in California. Human use of the area included backpacking and climbing. Hikers camped in very limited areas associated with the trail, water, and trees; climbers had the greatest potential effects on sheep. the levels of intrusion did not appear to be adversely affecting sheep, but if the number is allowed to increase the effects on sheep should be closely monitored (Boyle and Samson 1983).

141. Elgmark, K. and A. Langeland. POLLUTED SNOW IN SOUTHERN NORWAY DURING WINTERS 1968-1971. Environ. Pollution 4:41-52. 1973.

Note: new.

142. Enderson, J. H.; and J. Craig. STATUS OF THE PEREGRINE FALCON IN THE ROCKY MOUNTAINS. Auk; 91:727-736. 1974.

Factors responsible for an apparent decline in the numbers of peregrine falcons in the central Rocky Mountains are discussed. Pesticides appear to be the major factor; human disturbances such as rock climbing, picknicking, and highways may be important locally but are not widespread enough to explain the general decline (Boyle and Samson 1983).

143. Enger, P. S., H. E. Karlsen, F. R. Knudsen, and O. Sand. DETECTION AND REACTION OF FISH TO INFRASOUND. ICES Marine Sciences Symposia 196:108-112. 1993.
Note: new.

144. Erlich, P. R. EXTINCTION: WHAT IS HAPPENING NOW AND WHAT NEEDS TO BE DONE. In: Dynamics of Extinction, D. K. Elliott, ed., pp. 157-164. John Wiley and Sons, New York. 1986.
Note: new.

145. Escherich, P. C.; and L. Blum, eds. *PROC. BOBCAT RESEARCH CONF. National Wildlife Federation Scientific and Technical Series 6, Washington, D.C. 1979.

146. Evans, D. L. *STATUS REPORTS ON TWELVE RAPTORS. USDI, U.S. Fish Wildl. Serv. Special Sci. Rep. No. 238, Washington, D.C. 68 pp. 1982.

147. Fahrig, L. and G. Merriam. HABITAT PATCH CONNECTIVITY AND POPULATION SURVIVAL. Ecology 66:1762-1768. 1985.
Note: new.

148. Fancy, S. G.; and R. G. White. ENERGY EXPENDITURES BY CARIBOU WHILE CRATERING IN SNOW. J. Wildl. Manage.; 49(4):987-993. 1985.
The rate of energy expenditure by caribou digging in snow for lichens was determined by heart rate telemetry and an analysis of cratering mechanics. Based on a significant linear relationship between energy expenditure and heart rate, the mean cost per digging stroke in light, uncrusted snow was 118 J, whereas in denser (0.36 g/sq.cm) snow with a thin, hard crust the mean cost was 219 J/stroke. The cost of cratering through snow compacted by a snowmobile was 481 J/stoke. A comparison of metabolic and mechanical energy required for cratering suggested that caribou have evolved an energetically-efficient mechanism for obtaining food from beneath the snow layer.

149. Fay, R. R. HEARING IN VERTEBRATES: A PSYCHOPHYSICS DATABOOK. Hill-Fay Associates. Winnetka, Ill. 621 pp. 1988.
Note: new.

150. Fenton, M. B.; and G. P. Bell. *ECHOLOCATION AND FEEDING BEHAVIOR OF FOUR SPECIES OF MYOTIS (CHIROPTERA). Can. J. Zool.; 57:1271-1277. 1979.

151. Ferguson, M. A. D. and L. B. Keith. INFLUENCE OF NORDIC SKIING ON DISTRIBUTION OF MOOSE AND ELK IN ELK ISLAND NATIONAL PARK, ALBERTA. Can. Field-Nat. 99:69-78. 1982.
Note: new.

152. Ferguson, M. A.; and L. B. Keith. INTERACTIONS OF NORDIC SKIERS WITH UNGULATES IN ELK ISLAND NATIONAL PARK. Alberta Fish Wildl. Div. Wildl. Tech. Bull.; No. 6 31pp. 1981.

153. Fernandez, C.; and P. Azkona. HUMAN DISTURBANCE AFFECTS PARENTAL CARE OF MARSH HARRIERS AND NUTRITIONAL STATUS OF NESTLINGS. J. Wildl. Manage.; 57(3):602-608. 1993.
The authors studied the effects of human disturbance on parental care by marsh harriers (Cirus aeruginosus) in spring 1991 at Dos Reinos Lake, Ebro Valley, Spain. They assessed changes in reproductive activities and nutritional condition of nestlings due to low-level human disturbance during incubation and nestling phases. The number of food items delivered and the time spent by males and females in the nesting area and on the nest decreased during disturbed periods, especially during incubation, whereas behaviors related to stress (alarm calls, chases against other intruding birds, and percentage flying time) increased. Although annual productivity of the disturbed pairs was not affected, nestlings of disturbed birds exhibited levels of blood urea that were higher than those of undisturbed pairs. Thus, minor human disturbances may cause long-term effects on lifetime reproductive success of birds by increasing energy and time expenditure in non-reproductive activities and by reducing condition of nestlings.

154. Ferrin, R. S. and G. P. Coltharp. LEAD EMISSIONS FROM SNOWMOBILES AS A FACTOR IN LEAD CONTAMINATION OF SNOW. Proceedings of the Utah Academy of Science, Arts and Letters 51(1):116-118. 1974.
Note: new.

155. Findholt, S. L. STATUS AND DISTRIBUTION OF HERONS, EGRETS, IBISES AND RELATED SPECIES IN WYOMING. Colonial Waterbirds; 7:55-62. 1984.

156. Findholt, S. L.; and K. L. Diem. STATUS AND DISTRIBUTION OF AMERICAN WHITE PELICAN COLONIES IN WYOMING: AN UPDATE. Great Basin Nat.; 48:285-289. 1988.

157. Findholt, S. L.; and K. L. Berger. UPDATE ON THE STATUS AND DISTRIBUTION OF COLONIALLY NESTING WATERBIRDS IN WYOMING. Nongame Special Report, Wyoming Game and Fish Dept. 40 pp. 1987.

158. Fitts-Cochrane, J. LONG-BILLED CURLEW HABITAT AND LAND USE RELATIONSHIPS IN WESTERN WYOMING. M.S. thesis; Univ. Wyo., Laramie. 136 pp. 1983.

159. Fletcher, J. L. and R. G. Busnel, eds. EFFECTS OF NOISE ON WILDLIFE. Academic Press, Inc., New York. 1978.
Note: new.
Several papers, including a symposium on the effects on wildlife, quantifying the acoustic dose when determining the effects of noise on wildlife, and a perspective of government and public policy regarding noise and animals.

160. Foin, T. C., E. O. Garton, C. W. Bowen, J. M. Everingham, R. O. Schultz, and B. Holton, Jr. QUANTITATIVE STUDIES OF VISITOR IMPACTS ON ENVIRONMENTS OF YOSEMITE NATIONAL PARK, CALIFORNIA, AND THEIR IMPLICATIONS FOR PARK MANAGEMENT POLICY. Journal of Environmental Management 5:1-22. 1977.
Note: new.

161. Foresman, C. L., D. K. Ryerson, R. F. Johannes, W. H. Paulson, R. E. Rand, G. H. Tenpas, D. A. Schlough, and J. W. Pendleton. EFFECTS OF SNOWMOBILE TRAFFIC ON NON-FOREST VEGETATION: SECOND REPORT. School of Natural Resources, Univ. of Wisconsin, Madison, Wisc. 1973.
Note: new.

162. Foresman, K. R. *SOREX HOYI IN IDAHO: A NEW STATE RECORD. Murrelet; 67:81-82. 1987.

163. Franklin, A. B. *BREEDING BIOLOGY OF THE GREAT GRAY OWL IN SOUTH-EASTERN IDAHO AND NORTHWESTERN WYOMING. Condor: 90:689-696. 1988.

164. Fraser, J. D.; L. D. Frenzel; and J. E. Mathisen. THE IMPACT OF HUMAN ACTIVITIES ON BREEDING BALD EAGLES IN NORTH-CENTRAL ILLINOIS. J. Wildl. Manage.; 49:585-592. 1985.

165. Fraser, J. D.; L. D. Frenzell; and J. E. Mathisen. THE IMPACT OF HUMAN ACTIVITIES ON BREEDING BALD EAGLES IN NORTH-CENTRAL MINNESOTA. J. Wildl. Manage.; 49(3):585-592. 1985.

The impacts of human activities and eagle management practices on bald eagle nesting biology were studied on Chippewa National forest in north-central Minnesota. Nests built on developed shoreline were farther away from water than nests built on undeveloped shoreline. Breeding eagles flushed at 57-991 m at the approach of a pedestrian. Fixed-wing aircraft passing 20-200 m from nests did not flush incubating or brooding eagles. The authors found no evidence that, under present management policies, human activities have an important impact on bald eagle reproductive success on the Chippewa National Forest.

166. Freddy, D. J. DEER-ELK INVESTIGATIONS: SNOWMOBILE HARASSMENT OF MULE DEER ON COLD WINTER RANGES. Colo. Div. Wildl Project W-038-R-32/ WP14/J11. 15 pp. 1977.

Two semi-tame telemetered mule deer were experimentally harassed by one person, two persons, person plus a dog, and a snowmobile at various distances. Deer reactions to harassment were noted. Heart rate measured by telemetery was found to be sensitive measure of disturbance (Boyle and Samson 1983).

167. Freddy, D. J.; W. M. Bronaugh; and M. C. Fowler. RESPONSES OF MULE DEER TO DISTURBANCE BY PERSONS AFOOT AND SNOWMOBILES. Wildl. Soc. Bull.; 14:63-68. 1986.

The objectives of this study in north-central Colorado were to compare overt behavioral responses of adult female mule deer reacting to persons afoot or snowmobiles during controlled disturbance trials and to monitor their survival and fecundity. The tendency for flight distances to increase when deer exhibited multiple flight responses to persons afoot suggested that deer did not readily habituate to disturbance and these responses were longer in duration, involved running more frequently, and were greater in estimated energy expenditure. Minimizing all responses by deer would require persons afoot and snowmobiles to remain >334 m and > 470 m from deer, respectively. The authors concluded that their disturbance study did not markedly affect the mortality or fecundity of adult female deer.

168. French, J. M.; and J. R. Koplin. DISTRIBUTION, ABUNDANCE, AND BREEDING STATUS OF OSPREYS IN NORTHWESTERN CALIFORNIA. Pages 223-240 in: J. C. Ogden, ed. Trans. of the N. Am. Osprey Res. Conf.; 10-12 February 1972, Williamsburg, VA. U.S. Natl. Park Serv. Trans. Proc. Ser. 2. 1972.
Data are presented concerning abundance and reproduction of ospreys in California. Factors influencing fledgling productivity are discussed, including human disturbance. Logging and shooting were found to seriously affect nesting ospreys, but there was no indication that recreational activities including sightseeing, camping, fishing, and swimming were detrimental to breeding success of ospreys (Boyle and Samson 1983).

169. Fyfe, R. THE PEREGRINE FALCON IN NORTHERN CANADA. Pages 101-114 in: J. J. Hickey, ed. Peregrine falcon populations: their biology and decline. Univ. of Wisconsin Press, Madison. 1969.
Recent evidence suggests that the peregrine remains a common breeding bird in northern Canada, although a local decline was attributed to human disturbance. Human interference with peregrines near northern settlements is a possible deciminating factor.

170. Gabrielsen, G. W. and E. N. Smith. PHYSIOLOGICAL RESPONSES OF WILDLIFE TO DISTURBANCE. In: Wildlife and Recreation: Coexistence Through Management and Research, R. L. Knight and K. J. Gutzwiller, eds., pp. 95-107. Island Press, Washington, D.C. 1995.
Note: new.

171. Garber, D. P. OSPREY NESTING ECOLOGY IN LASSEN AND PLUMAS COUNTIES, CALIFORNIA. M.S. thesis; Humboldt State Univ., Arcata. CA. 59 pp. 1972.
Nesting efforts of ospreys were studied in northwestern California. Major cases of nesting failure was high winds and eggshell breakage, but human disturbance was responsible for 33% of observed egg losses. In one case, campers caused adult osprey to abandon a nest with eggs. During fledgling counts young ospreys sometimes flew from nests, apparently for the first time. Such early flights may increase the incidence of injury and predation of fledglings (Boyle and Samson 1983).

172. Garrott, R. A., G. White, R. M. Bartman, L. H. Carpenter, and A. W. Alldredge. MOVEMENTS OF FEMALE MULE DEER IN NORTHWEST COLORADO. Journal of Wildl. Mgmt. 51(3). 1987.
Note: new.
Migration was strongly correlated to winter severity. Demonstrated strong fidelity to summer and winter ranges. Fidelity of individual movement patterns is long term, possibly for life.

173. Garton, E. O.; C. W. Bowen; and T. C. Foin, Jr. THE IMPACT OF VISITORS ON SMALL MAMMAL COMMUNITIES OF YOSEMITE NATIONAL PARK. Pages 44-50 in: T. C. Foin, Jr. ed. Visitor impacts on National Parks: The Yosemite ecological impact study. Univ. California, Davis, Inst. Ecol. Pupl. 10. 1977.
Visitor use of meadow and forest sites in Yosemite National Park was related to the distribution and abundance of small mammals. Deer mouse populations apparently increase in response to human use of forested areas, while mountain vole populations showed no relationship to human use except for gross habitat alterations such as meadow draining. Data for other small mammals were insufficient to determine relationships with human use (Boyle and Samson 1983).

174. Gasoway, W. C.; R. O. Peterson; J. L. Davis; P. E. K. Shepard; and O. E. Burns. *INTERRELATIONSHIPS OF WOLVES, PREY, AND MAN IN INTERIOR ALASKA. Wildl. Monogr. No. 84. 50 pp. 1983.

175. Gavrin, V. F. EFFECT OF ANXIETY FACTOR ON GAME FOWL PRODUCTIVITY. Pages 401-403 in: I. Kjerner and P. Bjurholm, eds. Proc. XIth Int. Cong. of Game Biologists, 3-7 September 1973, Stockholm, Sweden. National Swedish Environmental Protection Board, Stockholm. 1974.
Effects of stress on waterfowl and grouse was studied in the USSR. Recreational activities in bird habitats disturb daily activity patterns and alter the behavior of birds. Disturbance causes additional predation pressures and losses of young to starvation; disrupted timing of breeding lowers female fertility and increases the number of inferior birds in the population (Boyle and Samson 1983).

176. Geist, V. A BEHAVIORAL APPROACH TO THE MANAGEMENT OF WILD UNGULATES. Pages 413-424 in: E. Duffy and A. S. Watts, eds. The scientific management of animal and plant communities for conservation. Symp. British Ecol. Soc. 11. Blackwell Sci. Publ., Oxford. 1971.

177. Geist, V. BEHAVIOR. In: Big Game of North America: Ecology and Management, J. L. Schmidt and D. C. Gilbert, eds., pp 283-296. Stackpole Books. Harrisburg, Penn. 494 pp. 1978.
Note: new.

178. Geist, V. BIGHORN SHEEP ECOLOGY. Wildl. Soc. News; 136:61. 1971.
In a letter to the editor, the author explains physiological and energetic concerns related to increased activity of bighorn sheep following removal of old rams from populations. Harassment of sheep and other animals by a combination of hunting and hiking/wildlife viewing may be fatal to sheep (Boyle and Samson 1983).

179. Geist, V. HARRASSMENT OF LARGE MAMMALS AND BIRDS: WITH A CRITIQUE OF THE RESEARCH SUBMITTED BY ARCTIC GAS STUDY LTD. ON THIS SUBJECT. Report to the Berger Commission 64pp. 1975.

180. Geist, V. IS BIG GAME HARASSMENT HARMFUL? Oilweek; 22(17):12-13. 1971.
Harassment of North American big game is considered in terms of animal energy budgets and physical damage. Energy “costs” of harassment are calculated as energy expended above and beyond normal daily expenditures. Chronic harassment may result in reduced reproductive rates and increased mortality (Boyle and Samson 1983).

181. Geist, V. ON THE BEHAVIOR OF THE NORTH AMERICAN MOOSE IN BRITISH COLUMBIA. Behavior; 20:377-416. 1963.
Calf and yearling moose are sometimes quite tame when adults are absent. The sight of man at close range causes most animals to run; however, there is considerable variation among individual moose. Cites case where moose did not take flight even when one of the group was shot. Intense feeding often occurs after disturbance has passed (Ream 1980).

182. Genter, D. l. *STATUS OF THE SPOTTED BAT (EUDERMA MACULATUM) IN THE PRYOR MOUNTAINS OF SOUTHCENTRAL MONTANA. Report to USDA, U.S. For. Serv., Custer National Forest, Billings. 17 pp. 1988.

183. Genter, D. L.; and L. H. Metzgar. *SURVEY OF THE BAT SPECIES AND THEIR HABITAT USE IN GRAND TETON NATIONAL PARK. Page 65-69 in: Wyoming-National Park Service Research Center, 9th Annual Report. 1985.

184. Gentor, D. L. *WINTERING BATS OF THE UPPER SNAKE RIVER PLAIN: OCCURENCE IN LAVA TUBE CAVES. Great Plains Nat.; 46:241-244. 1986.

185. George, J. L.; C. E. Braun; R. A. Ryder and E. Decker. RESPONSE OF WATERBIRDS TO EXPERIMENTAL DISTURBANCES. Proc. Issues Technol. Manage. Wildl. (Thorne Ecol. Inst.); No. 5, pp. 52-59. 1991.

186. Gerrard, J. M.; and G. R. Bortolotti. *THE BALD EAGLE: HAUNTS AND HABITS OF A WILDERNESS MONARCH. Smithsonian Institution Press, Washington, D.C. 177 pp. 1988.

187. Gese, E. M.; O. J. Rongstad; and W. R. Mytton. CHANGES IN COYOTE MOVEMENTS DUE TO MILITARY ACTIVITY. J. Wildl. Manage.; 53(2):334-339. 1989.
The authors investigated the response of coyotes to military activity on the Pinon Canyon Maneuver Site, Colorado, during 1984-86. Sixteen coyotes responded to military activity by expanding, contracting, abandoning, or not changing their home range during military maneuvers compared to before and after maneuvers. Three coyote abandoned their home ranges, with 1 animal returning to its original home range 1 week after maneuvers. Most coyotes that expanded their ranges during military maneuvers resumed their original home range after military maneuvers ceased. Responses appeared to be related to the amount of available cover, topography, and intensity of military activity in a coyote's home range. Coyote activity patterns during the day increased, while activity at sunrise, sunset, and night remained the same during military activity.

188. Gilpin, M. E. SPATIAL STRUCTURE AND POPULATION VIABILITY. In: Viable Populations for Conservation, M. E. Soule, ed., pp. 124-139. Cambridge University Press. 1987.
Note: new.

189. Gipson, P. S. ABORTION AND CONSUMPTION OF FETUSES BY COYOTES FOLLOWING ABNORMAL STRESS. Southwestern Naturalist 21:558-559. 1970.
Note: new.

190. Glinski, R. L. BIRDWATCHING ETIQUTTE: THE NEED FOR A DEVELOPING PHILOSOPY. Am. Bird; 30:655-657. 1976.
Examples of disturbance to nongame birds by bird watchers are used to indicate a need to manage bird watching. Disturbance can cause lowered survival and reproduction of birds due to increased energy expenditures, behavior alteration, abandonment of nests, or loss of eggs and young to chilling, overheating, or predation. A behavioral code for bird watchers is proposed to regulate personal activities (Boyle and Samson 1983).

191. Goldsmith, F. B. ECOLOGICAL EFFECTS OF VISITORS IN THE COUNTRYSIDE. Pages 217-231 in: A. Warren and F. B. Goldsmith, eds. Conservation in practice. Wiley and Sons, London. 1974.
Ecological effects of recreation are reviewed, including impacts on wildlife. Sections discuss carrying capacity, characteristics of ecosystems, succession, visitor distribution, effects of trampling, direct research on ecological effects of recreation, and management (Boyle and Samson 1983).

192. Gooders, J. WILDLIFE AND TOURISM. Birds Int.; 1:21-23, 27. 1975.
Wildlife tourism is described as a modern and expanding business. Direct and indirect benefits of tourism to wildlife conservation are contrasted with impacts including disturbance to wildlife. The author suggests that tourism will continue to expand, and that steps should be taken to minimize disturbances to wildlife (Boyle and Samson 1983).

193. Goodrich, J. M.; and J. Berger. WINTER RECREATION AND HIBERNATING BLACK BEARS URSUS AMERICANUS. Biol. Conserv.; 67(2): 105-110. 1994.

194. Goodson, N. J. STATUS OF BIGHORN SHEEP IN ROCKY MOUNTAIN NATIONAL PARK. M.S. thesis; Colorado State Univ., Fort Collins. 190 pp. 1978.
During studies of bighorn sheep in Rocky Mountain National Park, Colorado, sheep interactions with people were noted. In areas where sheep were accustomed to seeing people, they tolerated people if approached gradually and not too closely; however, on several occasions sheep were driven from feeding areas or mineral licks by visitors. Sheep in backcountry areas were more wary (Boyle and Samson 1983).

195. Graefe, A. R., F. R. Kruss, and J. J. Vaske. VISITOR IMPACT MANAGEMENT: THE PLANNING FRAMEWORK. National Parks and Conservation Association. Washington, D.C. 105 pp. 1990.
Note: new.

196. Graefe, A. R., F. R. Krass, and J. J. Vaske. VISITOR IMPACT MANAGEMENT. Vols. I and II. National Parks and Conservation Association. Washington, D.C. 1990.
Note: new.

197. Graham, H. ENVIRONMENTAL ANALYSIS PROCEDURES FOR BIGHORN IN THE SAN GABRIEL MOUNTAINS. Trans. Desert Bighorn Counc.; 15:38-45. 1971.
Graphic analysis was used to evaluate bighorn habitat in California. Human use impacts were portrayed on overlays and compared to bighorn distributions and other habitat characteristics. Human recreational use has caused sheep to avoid certain areas. Light use has little effect on sheep distributions, but heavier use (500-900 visitor-days per summer season) causes bighorns to move from their historic range (Boyle and Samson 1983).

198. Graham, H. THE IMPACT OF MODERN MAN. Pages 288-309 in: G. Monson and L. Sumner, eds. The desert bighorn: Its life history, ecology, and management. Univ. of Arizona Press, Tucson. 1980.
The history of man’s relationship with bighorn sheep and current impacts of man on sheep are reviewed. Effects of hiking, horseback riding, motor vehicles, motorboats, ski lifts and tramways, aircraft, noises, and dogs are discussed. Human-caused habitat alterations are related to tolerance of sheep to intrusions (Boyle and Samson 1983).

199. Graham, H. MULTIPLE USE COORDINATION ON THE SAN GORGONIO BIGHORN UNIT. Trans. Desert Bighorn Counc.; 10:71-77. 1966.
Multiple use management of a California national forest area containing bighorn sheep is discussed. The authors explains the rationale and methodology of multiple use, and describes various land uses and their coordination with bighorn management. Proposals for massive recreational developments have been rejected because of perceived incompatibility with preservation of key bighorn habitats (Boyle and Samson 1983).

200. Graul, W. D. *ADAPTIVE ASPECTS OF THE MOUNTAIN PLOVER SOCIAL SYSTEM. Living Bird; 12:69-94. 1973.
201. Graul, W. D. *BREEDING BIOLOGY OF THE MOUNTAIN PLOVER. Wilson Bull.; 87:6-31. 1975.
202. Graul, W. D. and G. C. Miller. STRENGTHENING ECOSYSTEM MANAGEMENT APPROACHES. Wildl. Soc. Bull. 12:282-289. 1984.
Note: new.
203. Graul, W. D.; and L. E. Webster. *BREEDING STATUS OF THE MOUNTAIN PLOVER. Condor; 78:265-267. 1976.
204. Gray, J. R. KINDS AND COSTS OF RECREATIONAL POLLUTION IN THE SANDIA MOUNTAINS. New Mexico State Univ., Las Cruces, Agric. Exp. Sta. Bull. 651. 57 pp. 1977.
Environmental costs of recreation in the Sandia Mountains, New Mexico, were quantified by surveying recreationists, identifying associated pollutants and environmental impacts, and calculating costs of their control. Wildlife harassment, primary by hikers, was among impacts that tended to restrict activities most in a cost analysis model. Nature study and hunter groups were determined as having the highest cost per hour (Boyle and Samson 1983).
205. Gray, J. A. PSYCHOLOGY OF FEAR AND STRESS, 2ND ED. Cambridge University Press. New York. 1987.
Note: new.
206. Greater Yellowstone Coordinating Committee. AN AGGREGATION OF NATIONAL PARK AND NATIONAL FOREST MANAGEMENT PLANS. A cooperative project of the NPS and NFS. 1987.
207. Greater Yellowstone Bald Eagle Working Team. A BALD EAGLE MANAGEMENT PLAN FOR THE GREATER YELLOWSTONE ECOSYSTEM. Wyoming Game and Fish Dept., Cheyenne. 82 pp. 1983.
208. Greater Yellowstone Bald Eagle Working Team. SIX-YEAR SUMMARY PRODUCTION REPORT FOR THE GREATER YELLOWSTONE ECOSYSTEM. Compiled and edited by Bob Jones and Russ McFarling, U.S. Bur. Land Manage., Idaho Falls, ID. 1989.
209. Greer, T. ENVIRONMENTAL IMPACT OF SNOWMOBILES: A REVIEW OF THE LITERATURE. Univ. of Oregon, Portland. 1979.
Note: new.
210. Gregory, S. V., F. J. Swanson, W. A. McKee, and K. W. Cummins. AN ECOSYSTEM PERSPECTIVE OF RIPARIAN ZONES. BioScience 41:540-551. 1991.
Note: new.
211. Greller, A. M., et al. SNOWMOBILE IMPACT ON THREE ALPINE TUNDRA PLANT COMMUNITIES. Environmental Conservation 1(2):101-110. 1974.
Note: new.
212. Grier, J. W.; J. B. Elder; F. J. Gramlich; N. F. Green; J. V. Kussman; J. E. Mathisen; and J. P. Mattsson. NORTHERN STATES BALD EAGLE RECOVERY PLAN. USDI; Fish and Wildlife Service. 1983.

213. Groves, C. R. *DISTRIBUTION OF THE WOLVERINE IN IDAHO AS DETERMINED BY MAIL QUESTIONNAIRE. Northw. Sci.; 62(4):181-185. 1988.

214. Grubb, T. G.; and R. M. King. ASSESSING HUMAN DISTURBANCE OF BREEDING BALD EAGLES WITH CLASSIFICATION TREE MODELS. J. Wildl. Manage.; 55(3):500-511. 1991.
The researchers recorded 4,188 events of human activity and associated bald eagle response in the vicinity of 13 central Arizona nest sites during 1983-1985. A hierarchical classification of 9 dependent parameters and 3 independent parameters was developed to quantify pedestrian, aquatic, vehicle, noise (gunshot/sonic boom), and aircraft disturbance groups. Type and frequency of response varied inversely with the distance from an eagle to the disturbance. Bald eagles were more often flushed from perches than nests and were most easily disturbed when foraging. Pedestrian was the most disturbing human activity, whereas aircraft was the least. A classification tree (CART) model was developed for pooled and group disturbances to evaluate response severity and to formulate disturbance-specific management criteria. The CART models ranked distance to disturbance as the most important classifier of eagle response, followed in decreasing order of discriminatory value by duration of disturbance, visibility, number of units per event, position relative to affected eagle, and sound. This procedure offers improved specificity in human disturbance assessment.

215. Grubb, T. G.; W. W. Bowereman; J. P. Geisy; and G. A. Dawson. REPONSES OF BREEDING BALD EAGLES, HALIAEETUS LEUCOCEPHALIS, TO HUMAN ACTIVITIES IN NORTHCENTRAL MICHIGAN. Canadian Field-Nat.; 106(4):443-453. 1992.
The authors recorded 714 events of potentially disturbing human activity near six pairs of Bald Eagles breeding in northcental Michigan in 1990. Vehicles and pedestrians elicited the highest response frequencies, but aircraft and aquatic activities were the most common. Magnitude of response was inversely proportional to median distance-to-disturbance. Seventy-five percent of all alert and flight responses occurred when activity was within 500m and 200m, respectively. Adults responded more frequently than nestlings, and at greater distance-to-disturbance when perched away from nests. May was the peak month for human activity, most of which occurred on weekends (60%) and afternoon (72%). Classification tree (CART) models are used to assess disturbance-specific response frequencies and to formulate management considerations.

216. Guth, R. W. FOREST AND CAMPGROUND BIRD COMMUNITIES OF PENINSULA STATE PARK, WISCONSIN. Passenger Pigeon; 40:489-493. 1978.
A study in Door County, Wisconsin, compared bird populations of mature forests, forest edge, and altered campground sites. Bird density and species diversity were least in forest sites, and greatest in campgrounds. Birds in campgrounds represented a greater percentage of common and widespread species, whereas several rare forest species were absent (Boyle and Samson 1983).

217. Guth, R. W. THE JUNK FOOD GUILD: BIRDS AND MAMMALS ON PICNIC GROUNDS AND IN RESIDENTIAL AREAS. Ill. Audubon Bull.; 189:3-7. 1979.
Birds and mammals of the junk food guild benefit from human recreation by finding scraps of food in picnic grounds of parks and forest preserves. Experiments in urban areas near Chicago, Illinois, revealed aspects of foraging behavior and food selection by residential area birds (Boyle and Samson 1983).

218. Gutzwiller, K. J. ASSESSING RECREATIONAL IMPACTS ON WILDLIFE: THE VALUE AND DESIGN OF EXPERIMENTS. Trans. N. Am. Wildl. Nat. Res. Conf.; 56:248-255. 1991.

219. Gutzwiller, K. J. RECREATIONAL DISTURBANCE AND WILDLIFE COMMUNITIES. In: Wildlife and Recreation: Coexistence Through Management and Research, R. L. Knight and K. J. Gutzwiller, eds., pp. 169-181. Island Press, Washington, D.C. 1995.
Note: new.

220. Gutzwiller, K. J. RECREATIONAL DISTURBANCE AND WILDLIFE COMMUNITIES. In: Wildlife and Recreation: Coexistence Through Management and Research, R. L. Knight and K. J. Gutzwiller, eds., pp. 169-181. Island Press. Washington, D.C. 1995.
Note: new.

221. Gutzwiller, K. J. SERIAL MANAGEMENT EXPERIMENTS: AN ADAPTIVE APPROACH TO REDUCE RECREATIONAL IMPACTS ON WILDLIFE. Trans. N. Am. Wildl. and Nat. Resour. Conf.; 58:528-536. 1993.

222. Haber, G. C. EIGHT YEARS OF WOLF RESEARCH AT MCKINLEY PARK. Alaska; 39(4):43-45, 59, 53-56. 1973.
These popular articles summarize research results and observations concerning wolves in Mount McKinley National Park, Alaska. Wolf social systems, behavior, and relationships to prey species and humans are discussed.

223. Hagen, A. and A. Langeland. POLLUTED SNOW IN SOUTHERN NORWAY AND THE EFFECT OF THE MELTWATER ON FRESHWATER AND AQUATIC ORGANISMS. Environ. Pollution 5:45-57. 1973.
Note: new.

224. Haines, H. E. J. SNOWMOBILES IN YELLOWSTONE: BIOMASS ALTERNATIVES TO REDUCE POLLUTION. Montana Dept. of Environmental Quality. Survey of Visitor Impact on Wildlife. Curtis Canyon Area, National Elk Refuge, Jackson, Wyo. 1984.
Note: new.

225. Hammitt, W. E. and D. N. Cole. WILDLAND RECREATION: ECOLOGY AND MANAGEMENT. John Wiley and Sons. New York.
Note: new.

226. Hammitt, W. E.; J. N. Dulin; and G. R. Wells. DETERMINANTS OF QUALITY WILDLIFE VIEWING IN GREAT SMOKY MOUNTAINS NATIONAL PARK. Wildl. Soc. Bull.; 21:21-30. 1993.
Factors affecting the quality of wildlife viewing for 384 visitors to Cades Cove, Great Smoky Mountains National Park, were surveyed. Wildlife visibility potential, visual encounters with wildlife, visitor expectation and preference standard toward visual encounters, importance of type and number of animals seen, and viewer behavior were regressed on quality of wildlife viewing during an 18 km auto tour. Respondents rated quality of viewing high, with most visitors seeing 5 or more types of wildlife, and nearly everyone seeing white-tailed deer. Expectations toward the variety and total numbers of animals seen, preference standards toward seeing black bears, and the viewing behaviors of stopping the car and using binoculars to enhance viewing were the best predictors of a quality wildlife viewing experience.

227. Hanley, S. E. WILDLIFE MANAGEMENT IN YELLOWSTONE NATIONAL PARK, 1962-1976. M.S. thesis; Univ. Wyo., Laramie. 130 pp. 1992.
228. Hare, C. T. and K. J. Springer. SNOWMOBILE ENGINE EMISSIONS AND THEIR IMPACT. Office of Air and Water Programs, Environmental Protection Agency, Southwest Research Institute. San Antonio, Tex. 1974.
Note: new.
229. Harrington, F. H.; and L. D. Mech. *WOLF HOWLING AND ITS ROLE IN TERRITORIAL MAINTENANCE. Behavior; 69(3-4):207-248. 1978.
230. Harris, L. D. and P. B. Gallagher. NEW INITIATIVES FOR WILDLIFE CONSERVATION: THE NEED FOR MOVEMENT CORRIDORS. In: Conservation Biology: The Theory and Practice of Nature Conservation, Preservation, and Management, P. L. Fiedler and S. K. Jain, eds., pp. 197-237. Chapman and Hall. New York. 1989.
Note: new.
231. Harrison, R. T. PREDICTING SNOWMOBILE ACOUSTIC IMPACT ON RECREATIONISTS. U.S. For. Ser. Equp. Dev. Center, ED&T Project No. 9227. San Dimas, Calif. 1980.
Note: new.
232. Hartmata, A. R. BALD EAGLE MOVEMENT AND HABITAT USE COMPLETION REPORT. Pages 10-39 in: B. Oakleaf, D. Belitsky, and S. Ritter, eds. Endangered and nongame bird and animal investigations. Ann. Completion Report. Period covered: April 15, 1986 to April 14, 1987. Wyoming Game and Fish Dept., Cheyenne. 189 pp. 1987.
233. Hartmata, A. R. *A COMPREHENSIVE ECOLOGICAL STUDY OF BALD EAGLES IN THE GREATER YELLOWSTONE ECOSYSTEM. Wyoming Game and Fish Dept., Cheyenne.
234. Hartmata, A. R. GREATER YELLOWSTONE BALD EAGLE MANAGEMENT PLAN. Greater Yellowstone Bald Eagle Working Group, Wyo. Game and Fish Dept., Lander, Wyo. 47 pp. 1996.
Note: new.
235. Hash, H. S. *WOLVERINE. Pages 574-585 in: M. Novak, J. Baker, M. Obbard, and B. Malloch, eds. Wild furbearer management and conservation in North America. Ministry of Natural Resources, Ontario. 1987.
236. Haug, E. A. *OBSERVATIONS ON THE BREEDING ECOLOGY OF THE BURROWING OWLS IN SASKATCHEWAN. M.S. thesis; University of Saskatchewan, Saskatoon. 1985.
237. Hayward, G. D. *HABITAT USE AND POPULATION BIOLOGY OF BOREAL OWLS IN THE NORTHERN ROCKY MOUNTAINS, U.S.A. Ph.D. Diss. University of Idaho, Moscow. 113 pp. 1989.
238. Hayward, G. D.; P. H. Hayward; and E. O. Garton. *HABITAT USE AND DISTRIBUTION OF THE BOREAL OWL IN CENTRAL IDAHO: ANNUAL PROGRESS REPORT. Dept. of Fish and Wildlife Resources, College of Forestry, Wildlife, and Range Sciences, Univ. Idaho, Moscow. 10 pp. 1987.

239. Hayward, G. D.; P. H. Hayward; and E. O. Garton. *MOVEMENTS AND HOME RANGE USE BY BOREAL OWLS IN CENTRAL IDAHO. In: R. W. Nero, C. R. Knapton, and R. J. Hamre, eds. Biology and conservation of northern forest owls: symposium proceedings. USDA, U.S. For. Serv. Gen, Tech Rep. RM-142, Rocky Mountain Forest and Range Exp. Sta., Fort Collins. 309 pp. 1987.
240. Hayward, G. D.; P. H. Hayward, E. O. Gaton; and R. Escano. *REVISED BREEDING DISTRIBUTION OF THE BOREAL OWL IN THE NORTHERN ROCKY MOUNTAINS. Condor; 89:431-432. 1987.
241. Heinrich, B.; B. Oakleaf; D. Flath; and W. Melquist. *A COOPERATIVE PROPOSAL FOR REINTRODUCTION OF PEREGRINE FALCONS IN ADJACENT AREAS OF IDAHO, MONTANA, AND WYOMING. Unpub. proposal. 19 pp. 1985.
242. Hendee, J. C., G. H. Stankey, and R. C. Lucas. WILDERNESS MANAGEMENT. Misc. Publ. No. 1365. USFS, Dept. of Agric. 38 pp. 1978.
Note: new.
243. Hendee, J. C.; and D. R. Potter. HUMAN BEHAVIOR AND WILDLIFE MANAGEMENT: NEEDED RESEARCH. Trans. N. Am. Wildl. Nat. Resourc. Conf.; 36:383-396. 1971.
Broad problem areas and specific questions about human behavior aspects of wildlife management are identified. Research should be directed toward various aspects of hunter behavior, nonconsumptive uses of wildlife, wildlife economics, and political-legal issues. As nonconsumptive use of wildlife increases, managers are challenged to both gain support from and supply satisfaction to appreciative users (Boyle and Samson 1983).
244. Henry, J. YELLOWSTONE WINTER GUIDE. Roberts Rinehart Publ., Niwot, CO. 95 pp. 1993.
245. Henry, W. RELATIONSHIPS BETWEEN VISITOR USE AND CAPACITY FOR KENYA'S AMBOSELI NATIONAL PARK. Ph.D. Dissertation. Fort Collins, Colorado: Colorado State University. 1980.
Note: new.
246. Hensen, P.; and T. A. Grant. *THE EFFECTS OF HUMAN DISTURBANCE ON TRUMPETER SWAN BREEDING BEHAVIOR. Wildl. Soc. Bull.; 19:248-257. 1991.
247. Hickey, J. J. *PEREGRINE FALCON POPULATIONS: THEIR BIOLOGY AND DECLINE. University of Wisconsin Press, Madison. 596 pp. 1969.
248. Hicks, L. L.; and J. M. Elder. HUMAN DISTURBANCE OF SIERRA NEVADA BIGHORN SHEEP. J. Wildl. Manage.; 43(4):909-915. 1979.
Direct observations, pellet transects, and hiker interviews were used to assess use overlap and nature of interactions between humans and bighorn sheep in California. Distance, juxtaposition, and herd size and composition were important factors in reaction of sheep to humans. Bighorn-human encounters were not adversely affecting the bighorn population; nevertheless, limitation of human use of the study area is recommended (Boyle and Samson 1983).
249. Hoak, J. H.; J. L. Weaver; and T. W. Clark. *WOLVERINES IN NORTHWESTERN WYOMING. Northw. Sci.; 56:156-161. 1982.

250. Hoffman, R. S. *NOTES ON SOREX IN THE NORTHERN ROCKY MOUNTAIN ALPINE ZONE. J. Mammal.; 41:230-234. 1960.
251. Hoffmann, R. S.; and J. G. Owen. *SOREX TENELLUS AND SOREX NANAUS. Mammalian species No. 131:1-4. 1980.
252. Hoffmann, R. S.; P. L. Wright; and F. E. Newby. *THE DISTRIBUTION OF SOME MAMMALS IN MONTANA. J. Mammal.; 50:579-604. 1969.
253. Hofmann, R. S.; and R. D. Fisher. *ADDITIONAL DISTRIBUTIONAL RECORDS OF PREBLES SHREW. J. Mammal.; 59:883-884. 1978.
254. Holmes, T. L.; R. L. Knight; L. Stegall; and G. R. Craig. RESPONSES OF WINTERING GRASSLAND RAPTORS TO HUMAN DISTRUBANCE. Wildl. Soc. Bull.; 21:461-468. 1993.
The authors measured the flushing responses and flushing distances of 6 species of diurnal raptors (American kestrels, merlins, prairie falcons, rough-legged hawks, ferruginous hawks, and golden eagles) exposed to walking and vehicle disturbances during winter in northern Colorado. Walking disturbances resulted in more flushes than vehicle disturbances for all species except prairie falcons. Although flush distance did not vary with disturbance type for the three falcon species, rough-legged hawks and golden eagles flushed at greater distances for walking disturbances and ferruginous hawks flushed at greater distances for vehicle disturbances. Merlins and prairie falcons perched along paved roads had shorter flush distances to walking disturbances than individuals perched along gravel roads. Rough-legged hawks perched nearer to the road flushed at greater distances than those farther away. American kestral, prairie falcons, and ferruginous hawks perched closer to the ground had greater flush distances than those perched higher. Dark-morph ferruginous and rough-legged hawks flushed at greater distances than light morphs. For walking disturbances, a linear relationship existed between flight distance and body mass, with lighter species flushing at shorter distances; however, this trend did not hold for vehicle disturbances.
255. Holyrod, J. C. OBSERVATIONS OF ROCKY MOUNTAIN GOATS ON MOUNT WARDLE, KOOENAY NATIONAL PARK, BRITISH COLUMBIA. Can. Field-Nat.; 81:1-22. 1967.
Behavior of mountain goats in British Columbia is described, including reactions to man. Goat responses to human presence varied according to season, herd size, and other circumstances. Goats were rarely aggressive toward the author, although two incidents are described in which a goat appeared to threaten him (Boyle and Samson 1983).
256. Hooper, R. G. NESTING HABITS OF COMMON RAVENS IN VIRGINA. Wilson Bull.; 89:233-242. 1977.
In a study of raven nesting habitats in Virginia, relationships of nesting ravens in response to human pressure was variable depending on the situation. Human activity should be restricted near active nests, despite the observed tenacity of some nesting pairs. Most birds would not be affected by recreation activity farther than 200 meters from nests (Boyle and Samson 1983).
257. Hoover, R. L.; and D. L. Wills, eds. *MANAGING FORESTED LANDS FOR WILDLIFE. Colorado Division of Wildlife in cooperation with USDA Forest Service, Rocky Mountain Region, Denver, CO. 459 pp. 1984.

258. Horejsi, B. SOME THOUGHTS AND OBSERVATIONS ON HARASSMENT OF BIGHORN SHEEP. Pages 149-155 in: Proc. of the Biennial Symposium of the Northern Bighorn Sheep Council, 10-12 February 1976, Jackson, WY. 1976.
Harassment and its possible effects on bighorn sheep are discussed. Active harassment results in visible responses by sheep, while passive harassment produces no visible response but may have psychological and physiological effects on sheep. Harassment has significant impacts on individuals and populations, leading to a variety of conditions which reduce fitness. Minimizing harassment of sheep should be given top priority among management objectives (Boyle and Samson 1983).
259. Horney, R. L. SNOWMOBILING: GUIDELINES, ENVIRONMENTAL IMPACT, LEGISLATION, PROGRAMMING. National Recreation and Park Association. Washington, D.C. 1970.
Note: new.
260. Hornocker, M. G. *AN ANALYSIS OF MOUNTAIN LION PREDATION UPON MULE DEER AND ELK IN THE IDAHO PRIMITIVE AREA. Wildl. Monogr. 21:1-39. 1970.
261. Hornocker, M. G. WINTER TERRITORIALITY IN MOUNTAIN LIONS. J. Wildl. Manage.: 33:457-464. 1969.
262. Hornocker, M. G.; and H. S. Hash. *ECOLOGY OF THE WOLVERINE IN NORTHWESTERN MONTANA. Can. J. Zool.; 59:1286-1301. 1981.
263. Houston, D. B. ECOSYSTEMS OF NATIONAL PARKS. Science; 172:648-651. 1971.
Management of U.S. National Parks is aimed at preserving park ecosystems in as pristine a condition as possible, and primarily involves preventing or compensating for human influences. So-called nonconsumptive uses such as sightseeing may in fact alter energy and geothermal pathways, disturbing park vegetation and wildlife. Managers must realize that these areas have a finite capacity for absorbing human disturbances (Boyle and Samson 1983).
264. Houston, J. DOGS VS. DEER. Colo. Outdoors; 17(1):22-23. 1968.
265. Hoyt, S. F. *THE ECOLOGY OF THE PILEATED WOODPECKER. Ecology; 38:246-256. 1957.
266. Hudson, R. J. and R. J. Christopherson. MAINTENANCE METABOLISM. In: Bioenergetics of Wild Herbivores, R. J. Hudson and R. G. White, eds. CRC Press, Boca Raton, Fla. 314 pp. 1986.
Note: new.
267. Huff, D. E.; and P. J. Savage. A CORRELATION OF DEER MOVEMENTS WITH SNOWMOBILE ACTIVITY IN MINNESOTA DURING WINTER. Proc. Midwest Fish Wildl. Conf.; 34:42-49. 1972.
Studies of telemetered white-tailed deer in Minnesota compared deer activities between areas of high and no snowmobile use. The size of deer home ranges was much reduced at the high use area, and snowmobile use appeared to force deer into less preferred habitats where nighttime radiant heat loss was greater (Boyle and Samson 1983).
268. Interagency Grizzly Bear Committee. *GRIZZLY BEAR COMPENDIUM. Interagency Grizzly Bear Committee, Missoula. 540 pp. 1987.

269. Interagency Grizzly Bear Committee. *INTERAGENCY GRIZZLY BEAR GUIDELINES. Interagency Grizzly Bear Committee, Missoula. 100 pp. 1986.

270. Irwin, L. and J. Peek. RELATIONSHIP BETWEEN ROAD CLOSURES AND ELK BEHAVIOR IN NORTHERN IDAHO. University of Idaho and USDA Forest Service, Technical Report. 1979.
Note: new.

271. Isakovic, I. EFFECTS OF LAND USE AND OUTDOOR RECREATION ON GAME POPULATIONS. Pages 351-356 in: I. Kjerner and P. Bjurholm, eds. Proc. XIth Int. Cong. of Game Biologists, 3-7 September 1973, Stockholm. 1974.
An overview of man's effect on game populations through land use and recreation is provided. Recreationists fleeing from polluted urban environments make demands on nature that must be harmonized with the capacity of the land to absorb them. Plans to control impacts of tourism must be worked out, especially in areas where it is no longer possible to reserve large areas of land for protection (Boyle and Samson 1983).

272. Ittner, R. D., D. R. Potter, J. K. Agee, and S. Anschell, eds. Conf. Proceedings: RECREATIONAL IMPACTS ON WILDLANDS. U.S. For. Serv. and U.S. Natl. Park Serv., R-6-001. Seattle, Wash. 341 pp. 1979.
Note: new.

273. Jacobsen, N. K. ALARM BRADYCARDIA IN WHITE-TAILED DEER FAWNS. Jour. of Mammalogy 60:343-349. 1979.
Note: new.
The near approach of humans will cause newborn fawns to drop to the ground. After 2 weeks old, the same stimulus will cause them to run.

274. Janssen, R. NOISE AND ANIMALS: PERSPECTIVES OF GOVERNMENT AND PUBLIC POLICY. Pages 287-301 in: J. L. Fletcher and R. G. Busnel, eds. Effects of noise on wildlife. Academic Press, New York. 1978.
Impacts of human-caused noise on wildlife and domesticated animals must be determined so that proper decisions can be made by policy makers. An animal-response model to quantify the effects of noise on animals is presented. Wildlife exposures to noise are generally involuntary and come from mobile sources such as airplanes and recreational vehicles (Boyle and Samsom 1983).

275. Jarvinen, J. A. and W. D. Schmidt. SNOWMOBILE USE AND WINTER MORTALITY OF SMALL MAMMALS. In: Proceedings of the 1971 Snowmobile and Off the Road Vehicle Research Symposium, M. Chubb, ed., pp. 130-140, Tech. Rep. No. 8, Recreation, Research and Planning Unit, Dept. Park and Recreation Resour. Michigan State Univ., East Lansing. 196 pp. 1971.
Note: new.
Study area: Minnesota. Used traps. Meadow vole, short-tailed shrew, white-footed mouse, ground squirrel, masked shrew and spotted skunk. Study showed increased mortality of small mammals, destroyed subnivean air spaces. Also a possibility of toxic air trapped in snow. Even conservative levels of snowmobiling on trails is destructive to wintering small mammals.

276. Johnsgard, P. A. *THE BIRDS OF THE ROCKY MOUNTAINS. Colorado Associated University Press, Boulder. 504 pp. 1986.

277. Johnsgard, P. A. *NORTH AMERICAN OWLS. Smithsonian Institution Press, Washington, D.C. 295 pp. 1988.
278. Johnsgard, P. A. *THE PLOVERS, SANDPIPERS, AND SNIPES OF THE WORLD. University of Nebraska Press, Lincoln. 493 pp. 1981.
279. Johnson, T. H. RESPONSES OF BREEDING PEREGRINE FALCONS TO HUMAN STIMULI. In: Proc. Southwest Raptor Management Symposium and Workshop, Gilinski et al., eds. National Wildlife Federation, Washington, D.C. 1988.
Note: new.
280. Jonkel, C. WINTER DISTURBANCE AND GRIZZLY BEARS. Border Grizzly Proj., Univ. Mont., Missoula, Spec. Rep. No. 46. 1980.
281. Jonkel, C. J.; and I. T. McCowan. *THE BLACK BEAR IN THE SPRUCE-FIR FOREST. Wildl. Monogr.; 27:1-57. 1971.
282. Jope, K. L. IMPLICATIONS OF GRIZZLY BEAR HABITUATION TO HIKERS. Wildl. Soc. Bull; 13:32-37. 1985.
283. Junge, J. A.; and R. S. Hoffman. *AN ANNOTATED KEY TO THE LONG-TAILED SHREWS OF THE UNITED STATES AND CANADA WITH NOTES ON MIDDLE AMERICAN SOREX. Univ. Kan. Nat. Hist. Occ. Pap.; 94:1-48. 1981.
284. Kaiser, M. S.; and E. K. Fritzell. EFFECTS OF RIVER RECREATIONISTS ON GREEN-BACKED HERON BEHAVIOR. J. Wildl. Manage.; 48(2):561-567. 1984.
The authors studied the effects of river recreationists on green-backed heron behavior in southeastern Missouri. They determined that feeding behavior of green-backed herons was adversely affected by human activity as evidenced by the observed reduction of foraging bouts.
285. Keating, K. A.; L.R. Irby; and W. F. Kasworm. MOUNTAIN SHEEP WINTER FOOD HABITS IN THE UPPER YELLOWSTONE VALLEY. J. Wildl. Manage.; 49(1):156-161. 1985.
286. Keddy, P. A., A. J. Spaovld, and C. J. Keddy. SNOWMOBILE IMPACT ON OLD FIELD AND MARSH VEGETATION IN NOVA SCOTIA, CANADA: AN EXPERIMENTAL STUDY. Environmental Management 3:409-415. 1979.
Note: new.
287. Keith, L. B. *POPULATION DYNAMICS OF WOLVES. Pages 66-77 in: L. N. Carbyn, ed. Wolves in Canada and Alaska: their status, biology, and management. Can. Wildl. Serv. Rep. No, 45, Ottawa. 135 pp. 1981.
288. Keller, S. R. and J. K. Berry. A BIBLIOGRAPHY OF HUMAN/ANIMAL RELATIONS. Univ. Press of America. Lanham, MD. 1985.
Note: new.
289. Kemp, H. TAPPING INTO THE FISH AND WILDLIFE EXPLOSION: COMMERCIAL ON-LINE DATA SOURCES. USDI, U.S. Fish Wildl. Ser. Leaflet 16, Washington, D.C. 1992.
290. King, M. M. and G. W. Workman. RESPONSE OF DESERT BIGHORN SHEEP TO HUMAN HARASSMENT: MANAGEMENT IMPLICATIONS. Transactions of the North American Wildlife and Natural Resources Conference 51:74-85. 1986.
Note: new.

291. Kirby, R. E. IMPACT OF HUMAN ACTIVITY UPON WILDLIFE AND WILDLIFE HABITAT. Statement of Work, Office Info. Transfer, Res. and Develop., U.S. Fish and Wildl. Serv. 3 pp. 1985.
Note: new.
292. Kirkpatrick, C. M., ed. PROCEEDINGS: WILDLIFE AND PEOPLE. Dept. For. Nat. Resour., Purdue Univ., Lafayette, Ind. 191 pp. 1985.
Note: new.
293. Klein, M. L. WATERBIRD BEHAVIORAL RESPONSES TO HUMAN DISTURBANCES. Wildl. Soc. Bull.; 21:31-39. 1993.
The author subjected waterbirds to experimental disturbance at the J. N. “Ding” Darling National Wildlife Refuge, located off the southern gulf coast of Florida, to investigate the effects of human actions on their behavior. Approaching the birds on foot was the most disruptive activities of refuge visitors. Photographers were most likely to engage in this activity. Visitors who spoke with refuge staff early during their visit caused the least disturbance. The author conclude that educational programs, coupled with the use of observation blinds or guided tours, could help reduce bird disturbance.
294. Klein, T. LOON MAGIC. Paper Birch Press, Ashland, WI. 130 pp. 1985.
295. Knight, R. L. and S. K. K. Skagen. EFFECTS OF RECREATIONAL DISTURBANCE ON BIRDS OF PREY: A REVIEW. In: Proceedings of the Southwest Raptor Management Symposium and Workshop, L. Glinski et al., eds., pp. 355-359. National Wildlife Federation, Washington, D.C. 1988.
Note: new.
296. Knight, R. L. and d. N. Cole. FACTORS THAT INFLUENCE WILDLIFE RESPONSES TO RECREATIONISTS. In: Wildlife and Recreationists: Coexistence Through Management and Research, R. L. Knight and K. J. Gutzwiller, eds., pp. 71-79. 1995.
Note: new.
297. Knight, R. L. RESPONSES OF WINTERING BALD EAGLES TO BOATING ACTIVITY. J. Wildl. Manage.; 48(3):999-1004. 1984.
The author examined flushing responses and flight distances of wintering bald eagles disturbed by a canoe in northwestern Washington. Management implications are discussed.
298. Knight, R. L. and K. J. Gutzwiller, eds. WILDLIFE AND RECREATIONISTS: COEXISTENCE THROUGH MANAGEMENT AND RESEARCH. Island Press. Washington, D.C. 372 pp. 1995.
Note: new.
Physiological and psychological responses, indirect effects, management strategies, case histories, ethics, historical perspectives.
299. Knight, R. L.; and D. N. Cole. EFFECTS OF RECREATIONAL ACTIVITY ON WILDLIFE IN WILDLANDS. Trans. N. Am. Wildl. and Nat. Resour. Conf.; 56:238-247. 1991.
300. Knight, R. L.; and L. L. Eberhardt. *POPULATION DYNAMICS OF YELLOWSTONE GRIZZLY BEARS. Ecology; 66:323-334. 1985.

301. Knight, R. L.; B. M. Blancard; and L. L. Eberhardt. MORTALITY PATTERNS AND POPULATION SINKS FOR YELLOWSTONE GRIZZLY BEARS, 1973-1985. Wildl. Soc. Bull.; 16:121-125. 1988.
This study determined that the extensive movements of grizzly bears and dispersion of population sinks in time in space suggest there are no true refuges for Yellowstone grizzly bears. Increasing human use and recreational activities in the Yellowstone area will increase this problem. For the present, available food for bears at population sinks is the greatest threat to survival of the Yellowstone grizzly population.
302. Knight, R. L.; J. Beecham; B. Blanchard; L. Eberhardt; L. Metzgar; C. Serveen; and F. Talbot. *REPORT OF THE YELLOWSTONE GRIZZLY BEAR POPULATION TASK FORCE. Submitted to the Interagency Grizzly Bear Committee. Unpub. 9 pp. 1988.
303. Knight, S. K. and R. L. Knight. VIGILANCE PATTERNS OF BALD EAGLES FEEDING IN GROUPS. Auk 103:263-272. 1986.
Note: new.
304. Kolenosky, G. B.; and S. M. Strathearn. *BLACK BEAR. Pages 445-454 in: M. Novak, J. A. Baker, M. E. Obbard, and B. Malloch, eds. Wild furbearer management and conservation in North America. Ministry of Nat. Resources, Ontario. 1987.
305. Kopischke, E. D. EFFECTS OF SNOWMOBILE ACTIVITY ON THE DISTRIBUTION OF WHITE-TAILED DEER IN SOUTH CENTRAL MINNESOTA. Dept. Nat. Res. Game Research Proj. Rept. 1972.
Note: new.
306. Korschgen, C. E.; and R. B. Dahlgren. HUMAN DISTURBANCES OF WATERFOWL: CAUSES, EFFECTS, AND MANAGEMENT. USDI, U.S. Fish Wildl. Ser. Leaflet 13.2.15. 1992.
307. Krausman, P. R.; B. D. Leopold; and D. L. Scarbrough. DESERT MULE DEER RESPONSE TO AIRCRAFT. Wildl. Soc. Bull.; 14:68-70. 1986.
Responses of desert mule deer to aircraft overflights in Arizona rarely involved changing habitat. The authors conclude that the desert mule deer in southcentral Arizona appear to have habituated to low-flying aircraft and that reliable habitat-use information can be obtained from aircraft.
308. Krueger, C. D., J. Decker, and T. A. Gavin. A CONCEPT OF NATURAL RESOURCE MANAGEMENT: AN APPLICATION TO UNICORNS. Trans. Northeast Sect. Wildl. Soc. 43:50-56. 1986.
Note: new.
A simplified, idealized conceptual model for resource management.
309. Krutzsch, P. H. *NOTES ON THE HABITS OF THE BAT MYOTIS CALIFORNICUS. J. Mammal.; 35:539-545. 1954.
310. Kuchel, C. R. SOME ASPECTS OF THE BEHAVIOR AND ECOLOGY OF HARLEQUIN DUCKS BREEDING IN GLACIER NATIONAL PARK. M.S. thesis; University of Montana, Missoula. 163 pp. 1977.
311. Kugler, B. A. and D. S. Barber. A METHOD FOR MEASURING WILDLIFE NOISE EXPOSURE IN THE FIELD (Abstract). Journ. of the Acoustical Society of America 93(4):2378. 1993.
Note: new.

312. Kunz, T. H.; and R. A. Martin. *PLECOTUS TOWNSENDII. Mammalian Species No. 175:1-6. 1982.
313. Kuss, F. R., A. R. Graefe, and J. J. Vaske. VISITOR IMPACT MANAGEMENT: A REVIEW OF RESEARCH. National Parks and Conservation Association. Washington, D.C. 362 pp. 1990.
Note: new.
314. Kuyt, E. CLUTCH SIZE, HATCHING SUCCESS, AND SURVIVAL OF WHOOPING CRANE CHICKS, WOOD BUFFALO NATIONAL PARK, CANADA. Pages 126-129 in: J. C. Lewis and H. Masatomi, eds. Crane research around the world. International Crane Foundation, Baraboo, WI. 1981.
315. Lacey, R. M., R. S. Baran, W. D. Severinghaus, and D. J. Hunt. EVALUATION OF LANDS FOR RECREATIONAL SNOWMOBILE USE (GUIDELINES FOR NATURAL RESOURCES MANAGEMENT AND LAND USE COMPATIBILITY). Construction Engineering Research Lab. (Army). Champaign, Ill. 1981.
Note: new.
316. Lavigne, G. R. WINTER RESPONSE OF DEER TO SNOWMOBILES AND SELECTED NATURAL FACTORS. M.S. thesis, University of Maine, Orono. 68 pp. plus supplement. 1976.
Snowmobile trails enhanced deer mobility during periods of deep snow in Maine, and probably reduced deer energy expenditures in winter; deer used snowmobile trails more extensively near major bedding area. Disturbance by snowmobiles did not cause deer to abandon preferred bedding and feeding sites. Deer responses to snowmobiles varied from running out of sight to staying in place, depending on conditions of the encounter (Boyle and Samson 1983).
317. Lee, M. E., D. R. Field, and K. Schwarzkopf. PEOPLE, HUMAN BEHAVIOR AND ANIMALS IN PARKS AND PRESERVES: A WORKING BIBLIOGRAPHY. Natl. Park Serv., Coop. Park Stud. Unit Publ. CPSU/OSU 84-11. Coll. For., Oregon State Univ., Corvallis. 35 pp. 1984.
Note: new.
318. Leedy, D. H. HIGHWAY-WILDLIFE RELATIONSHIPS. VOL. 1. A STATE-OF-THE-ART REPORT. Fed. Hwy. Admin., Office Res. Develop. FHWA-RD-76-5. 417 pp. 1975.
*Annotated Bibliography.
319. Leedy, D. H.; T. M. Franklin; and C. E. Hekimian. HIGHWAY-WILDLIFE RELATIONSHIPS. VOL. 2. AN ANNOTATED BIBLIOGRAPHY. Fed. Hwy. Admin., Office Res. Develop. FHWA-RD-76-5. 417 pp. 1975.
*Annotated Bibliography.
320. LeResche, R. E. BEHAVIOR AND CALF SURVIVAL IN ALASKA MOOSE. M.S. thesis; Univ. Alaska, Fairbanks. 85 pp. 1966.
Reactions of moose to human disturbance ranged from flight, through slowly drifting away, to seeming disinterest. Cows with calves were the most wary (Ream 1980).

321. Levenson, H.; and J. R. Koplin. EFFECTS OF HUMAN ACTIVITY ON PRODUCTIVITY OF NESTING OSPREYS. J. Wildl. Manage.; 48(4):1374-1377. 1984.
The authors in this study evaluated the effects of human activity on the productivity of ospreys nesting in northwestern California during the early 1970s. The major form of intense human activity in the study is logging and the authors concluded that logging operations should be designed to minimize disruption of nesting ospreys, possibly by delaying operations in the area until young have fledged.

322. Liddle, M. J. A SELECTIVE REVIEW OF THE ECOLOGICAL EFFECTS OF HUMAN TRAMPLING ON NATURAL ECOSYSTEMS. Biol. Conserv.; 7(1):17-36. 1975.

323. Lieb, J. W. ACTIVITY, HEART RATE, AND ASSOCIATED ENERGY EXPENDITURE IN ELK OF WESTERN MONTANA. Ph.D. Thesis, Univ. of Montana, Missoula. 200 pp. 1981.
Note: new.

324. Light, J. T., Jr. AN ECOLOGICAL VIEW OF BIGHORN HABITAT ON MT. SAN ANTONIO. Trans. N. Am. Wild Sheep Conf.; 1:150-157. 1971.
Ecological analysis of a California sheep range revealed relationships between bighorn habitat use and human disturbance associated with a ski resort and a summer cabin. It was found that bighorn use did not occur where human use was heavy and sheep were forced into less satisfactory habitats (Boyle and Samson 1983).

325. Lime, D. W.; D. H. Anderson; and L. D. Mech. INTERPRETING WILDLIFE THROUGH GUIDED EXPEDITIONS. J. Interpret 3(2):10-16. 1978.
Guided expeditions were initiated in the Superior National Forest of Minnesota. People participating in wolf-howling safaris and wildlife-sign safaris had fun (in spite of only indirect encounters with wildlife) and at the same time learned about wildlife. This concept could be a useful method of public education about wildlife (Ream 1980).

326. Lindberg, K. and D. E. Hawkins, eds. ECOTOURISM: A GUIDE FOR PLANNERS AND MANAGERS. The Ecotourism Society. North Bennington, Vermont. 1993.
Note: new.

327. Lindenmayer, D. B. and H. A. Nix. ECOLOGICAL PRINCIPLES FOR THE DESIGN OF WILDLIFE CORRIDORS. Conservation Biology 7:627-630. 1973.
Note: new.

328. Lindzey, F. *MOUNTAIN LION. Pages 657-668 in: M. Novak, J. A. Baker, M. E. Obbard, and B. Malloch, eds. Wild furbearer management and conservation in North America. Ministry of Natural Resources, Ontario. 1987.

329. Lockman, D. C.; R. Wood; H. Smith; B. Smith; and H. Burgess. ROCKY MOUNTAIN TRUMPETER SWAN POPULATION-WYOMING FLOCK. 1982-86 Progress Report. Wyoming Game and Fish Dept., Cheyenne. 74 pp. 1987.

330. Lodico, N. J. ENVIRONMENTAL EFFECTS OF OFF-ROAD VEHICLES: A REVIEW OF THE LITERATURE. USDI Office of the Secretary, Washington, D.C. 1973.
Note: new.

331. Lodico, N. J. ENVIRONMENTAL EFFECTS OF VEHICLES: A REVIEW OF THE LITERATURE. USDI Research Services Branch, Bibliographic Service, Ofc. of Library Services, Bibliography Series No. 29. Washington, D.C. 109 pp. 1973.
Note: new.

332. Long, C. A. *MICROSOREX HOYI AND MICROSOREX THOMPSONI. Mammalian Species No. 33:1-4. 1974.
333. Lopez, B. H. *OF WOLVES AND MEN. Charles Schribner's Sons, New York. 304 pp. 1978.
334. Lyon, L. J. ROAD DENSITY MODELS DESCRIBING HABITAT EFFECTIVENESS FOR ELK. Journal of Forestry, September:592-595. 1983.
Note: new.
Forest roads evoke an avoidance response by elk.
335. MacAarthur, R. H. and E. O. Wilson. THEORY OF ISLAND BIOGEOGRAPHY. Princeton University Press, Princeton, N. J. 1967.
Note: new.
336. MacArthur, R. A.; R. H. Johnson; and V. Geist. FACTORS INFLUENCING HEART RATE IN FREE-RANGING BIGHORN SHEEP: A PHYSIOLOGICAL APPROACH TO THE STUDY OF WILDLIFE HARASSMENT. Can. J. Zool.; 57:2010-2021. 1979.
Heart rates of unrestrained female bighorn sheep were measured by telemetery in Alberta. In all ewes studied heart rate varied positively with activity level and inversely with distance from a road. Responses to other stimuli varied. Findings are discussed in relation to ecology and bioenergetics of bighorn sheep (Boyle and Samson 1983).
337. MacArthur, R. A.; V. Geist; and R. H. Johnson. CARDIAC AND BEHAVIORAL RESPONSES OF MOUNTAIN SHEEP TO HUMAN DISTURBANCE. J. Wildl. Manage.; 46:351-358. 1982.
338. MacNab, J. WILDLIFE MANAGEMENT AS SCIENTIFIC EXPERIMENTATION. Wildl. Soc. Bull. 11:397-401. 1983.
Note: new.
339. Maldague, M. IMPACT OF SNOWMOBILES ON THE FOREST ENVIRONMENT. Forest Conservation 39(9):6-8. 1973.
Note: new.
340. Manfredo, M. J., J. J. Vaske, and D. J. Decker. HUMAN DIMENSIONS OF WILDLIFE MANAGEMENT: BASIC CONCEPTS. In: Wildlife and Recreationists: Coexistence Through Management and Research, R. L. Knight and K. J. Gutzwiller, eds., pp. 17-31. Island Press, Washington, D.C. 1995.
Note: new.
341. Manfredo, M. J.; and R. A. Larson. MANAGING FOR WILDLIFE VIEWING RECREATION EXPERIENCES: AN APPLICATION IN COLORADO. Wildl. Soc. Bull.; 21:226-236. 1993.
342. Manning, R. E. IMPACTS OF RECREATION ON RIPARIAN SOILS AND VEGETATION. Water Resources Bulletin 50:30-43. 1979.
Note: new.
343. Manuwal, D. A. EFFECT OF MAN ON MARINE BIRDS: A REVIEW. In: Proc. Wildlife and People, C. M. Kirkpatrick, ed., pp. 140-160. Purdue Res. Foundation, West Lafayette, Ind. 1978.
Note: new.

344. March, D.; and C. Adams. A FRONT RANGE CONCEPT: THE NEED FOR THE NODDLES-RAMPART-SOUTH PLATTE RECREATION AREA. Wildlife-2000, Aurora, CO. 112 pp. plus appendices. 1973.
Results of a comprehensive study of wildlife, motorized recreation vehicles, and forest management in central Colorado are reported. Impacts of off-road vehicles on wildlife are severe, especially when engine noise is loud. Human recreational activities have accelerated habitat change which threaten vital watersheds and the wildlife which inhabit them (Boyle and Samson 1983).

345. Marshall, O. PRELIMINARY STUDIES ON THE EFFECTS OF SNOWMOBILE COMPACTION ON SOME TERRESTRIAL INVERTEBRATES. Amer. Zool. 1972.
Note: new.

346. Masyk, W. J. SNOWMOBILE, A RECREATION TECHNOLOGY IN BANFF NATIONAL PARK; ENVIRONMENTAL IMPACT AND DECISION-MAKING. Univ. of Calgary; The Univ. of Western Ontario, London, Ontario. 1973.
Note: new.

347. Mathisen, J. E. EFFECTS OF HUMAN DISTURBANCE ON NESTING BALD EAGLES. J. Wildl. Manage.; 32:1-6. 1968.
Bald eagle nesting success in Minnesota was studied in relation to intensity of several forms of human disturbance, including recreational activities. Human disturbance did not appear to significantly affect nest occupancy or nesting success (Boyle and Samson 1983).

348. Mayes, A. THE PHYSIOLOGY OF FEAR AND ANXIETY. In: Fear in Animals and Man, W. Sluckin, ed., pp. 24-55. Van Nostrand Reinhold Company, New York. 1979.
Note: new.
Physiological and behavioral responses to disturbance.

349. McClellan, B. N.; and D. M. Shackleton. IMMEDIATE REACTIONS OF GRIZZLY BEARS TO HUMAN ACTIVITIES. Wildl. Soc. Bull.; 17:269-274. 1989.
This study evaluated the responses of grizzly bears to human activities such as people on foot either next to or away from a parked vehicle, moving vehicles, heavy industrial equipment, fixed-wing aircraft, and helicopters. Bears responded more strongly to people on foot in remote areas than to any other stimuli. Management implications are discussed.

350. McCool, S. F. SNOWMOBILES, ANIMALS, AND MAN: INTERACTIONS AND MANAGEMENT ISSUES. Trans. North Amer. Wildl. and Nat. Resour. Conf. 43:140-148. 1978.
Note: new.

351. McCool, S. F. SNOWMOBILES, ANIMALS, AND MAN: INTERACTIONS AND MANAGEMENT ISSUES. The Wildlife Management Institute. Washington, D.C. 23 pp. 1978.
Note: new.

352. McCool, S. F. and B. Curtis. SOURCES OF CONFLICT AMONG WINTER RECREATIONISTS. In: Proc. North American Symposium on Dispersed Winter Recreation, pp. 73-77. Univ. of Minn. Office of Spec. Prog., Educ. Ser. 2-3. 1980.
Note: new.

353. McCord, C. M. and J. E. Cardoza. *BOBCAT AND LYNX. Pages 728-766 in: J. A. Chapman and G. A. Feldhamer, eds. Wild mammals in North America: biology, management, and economics. John Hopkins Univ. Press, Baltimore. 1982.

354. McGarigal, K.; R. G. Anthony and F. B. Issacs. INTERACTIONS OF HUMANS AND BALD EAGLES ON THE COLUMBIA RIVER ESTUARY. Wildlife Monograph; No. 15; 47p. 1991.
Note: Available at $4.50 from Wildl. Soc., 5410 Grosvenor Ln., Bethesda, MD 2014.

355. McIntyre, J. M. W. BIOLOGY AND BEHAVIOR OF THE COMMON LOON WITH REFERENCE TO ITS ADAPTABILITY IN A MAN-ALTERED ENVIRONMENT. Ph.D. Diss. Univ. of Minnesota, St. Paul. 243 pp. 1975.
Loons are subject to hazards from pollutants and increased recreational use because of their aquatic habits and conflict with man for habitat. Biological factors of loons were studied to assess their ability to adapt to these environmental changes. Their potential for maintaining stable populations in Minnesota are described based on the research results (Boyle and Samson 1983).

356. McMillan, J. F. SOME OBSERVATIONS ON MOOSE IN YELLOWSTONE NATIONAL PARK. Am. Midl. Nat.; 52(2):392-399. 1954.
In areas of heavy tourist pressure, moose develop considerable tolerance for human disturbance, moving slowly and returning soon. In a control area visitor disturbance caused moose to run from area and not return until at least the next day (Ream 1980).

357. McReynolds, H. E.; and R. E. Radtke. THE IMPACT OF MOTORIZED HUMANS ON THE WILDLIFE OF FORESTED LANDS. Pages 102-117 in: C. M. Kilpatrick. ed. Wildlife and people. Proc. of the 1978 John S. Wright Forestry Conf., 23-24 February 1978, Purdue Univ., West Lafayette, IN. 1978.
Effects of off-road vehicles on wildlife of forested lands are reviewed. Cases for and against the use of snowmobiles, motorcycles, and four-wheel drive vehicles in forests are presented. Few reliable data on off-road vehicle impacts on wildlife are available, but it is probable that indirect effects and unintentional harassment of wildlife have produced the greatest damage (Boyle and Samson 1983).

358. Meagher, M., S. Cain, T. Toman, J. Kropp, and D. Bosman. BISON IN THE GREATER YELLOWSTONE AREA: STATUS, DISTRIBUTION AND MANAGEMENT. Paper presented at the National Brucellosis Symposium, Jackson Hole, Wyo., September. 1994.
Note: new.

359. Meagher, M. THE BISON OF YELLOWSTONE NATIONAL PARK: PAST AND PRESENT. Ph.D. Dissertation, Univ. of Calif., Berkeley. 172 pp. 1970.
Note: new.

360. Meagher, M. *THE BISON OF YELLOWSTONE NATIONAL PARK. Natl. Park Serv. Sci. Monogr. 1:1-161. 1973.

361. Meagher, M. EVALUATION OF BOUNDARY CONTROL FOR BISON OF YELLOWSTONE NATIONAL PARK. Wildl. Soc. Bull.; 17:15-19. 1989.
Efforts made since 1976 to contain bison within the boundaries of Yellowstone National Park have proved to be ineffective. This paper evaluates several tactics to minimize the potential conflict of bison leaving the park. Hazing and herding activities demonstrated that bison can be moved only where they want to go. Attempts to block travel routes and harassment with various devices sometimes treated immediate problems at the locations involved, but did not change the overall direction of bison movement down the Yellowstone River. Further, these tactics apparently caused major shifts to other travel routes or sometimes displaced a conflict from 1 site to another. The author concludes that, in general, success (if any) in localized displacement of bison by human efforts will decrease and hazards to personnel will increase with these management approaches. Cropping of bison by public hunting outside the park will not change their movements, but may lessen local conflicts.

362. Meagher, M. RANGE EXPANSION BY BISON OF YELLOWSTONE NATIONAL PARK. Journal of Mammal. 70:670-675. 1989.
Note: new.
Bison use of plowed roads, an increase in numbers, acquired knowledge of new foraging areas, and the natural gregariousness of bison contributed to range expansion.

363. Meagher, M. WINTER WEATHER AS A POPULATION REGULATING INFLUENCE ON FREE-RANGING BISON IN YELLOWSTONE NATIONAL PARK. In: Research in Parks, Transactions of the National Park Centennial Symposium of the American Association for the Advancement of Science, Dec. 28-29, 1971. Ser. No. 1. Washington, D.C.: U.S. Government Printing Office. 232 pp. 1976.
Note: new.

364. Meagher, M. WINTER RECREATION-INDUCED CHANGES IN BISON NUMBERS AND DISTRIBUTION IN YELLOWSTONE NATIONAL PARK. Draft, report to management, unpublished. 48 pp. 1993.
Note: new.
Snow-packed roads used for winter recreation in the interior of the park appeared to be the major influence in major changes that occurred in bison numbers and distribution in Yellowstone, during the past decade. The entire bison population is involved, effects will ultimately occur on the ecosystem level. Range expansion, major shifts among subpopulations, mitigation of winterkill, and enhanced calf survival have resulted.

365. Meagher, M. WINTER RECREATION-INDUCED CHANGES IN BISON NUMBERS AND DISTRIBUTION IN YELLOWSTONE NATIONAL PARK. Unpublished. 1993.
Note: new.

366. Mech, L. D. *CANIS LUPUS. Mammalian Species No. 37. 6 pp. 1974.

367. Mech, L. D. *THE WOLF-THE ECOLOGY AND BEHAVIOR OF AN ENDANGERED SPECIES. Natural History Press, Doubleday, New York. 384 pp. 1970.

368. Mech, L. D. THE WOLVES OF ISLE ROYALE. Fauna of the National Parks of the U.S.; Fauna Series No. 7, U.S. Govt. Printing Office, Washington, D.C. 219 pp. 1966.
Gives occasional insights into the responses of wolves to the researcher on the ground, and to the aircraft used for observations. The researcher was not threatened by wolves, even when he examined recent kills. the wolves became habituated to the airplane used for observations and usually did not run even when repeatedly buzzed as low as 40 feet (Ream 1980).
369. Mech, L. D.; S. H. Fritts; G. L. Radde; and W. J. Paul. WOLF DISTRIBUTION AND ROAD DENSITY IN MINNESOTA. Wildl. Soc. Bull.; 16:85-87. 1988.
370. Mech, L. D.; T. J. Meier; and J. W. Burch. DENALI PARK WOLF STUDIES: IMPLICATIONS FOR YELLOWSTONE. Trans. N. Am. Wildl. Nat. Res. Resour. Conf.; 56:86-90. 1991.
371. Mech. L. D. WOLF POPULATION SURVIVAL IN AN AREA OF HIGH ROAD DENSITY. Am. Midl. Nat.; 121:387-389. 1989.
372. Melquist, W. E.; and M. G. Hornocker. *ECOLOGY OF RIVER OTTERS IN WEST CENTRAL IDAHO. Wildl. Monogr. No. 83:1-60. 1983.
373. Melquist, W. E.; and A. Dronkert. *RIVER OTTER. Pages 625-641 in: M. Novak; J. A. Baker; M. E. Obbard; and B. Malloch, eds. Wild furbearer management and conservation in North America. Ministry of Natural Resources. Ontario. 1987.
374. Mietz, J. D. SNOWMOBILE IMPACT ON FOREST VEGETATION AT HEIBERG FOREST, NEW YORK. State University of New York, College of Environmental Science and Forestry, Syracuse. 1974.
Note: new.
375. Miller, S. G. and R. L. Knight. IMPACTS OF RECREATIONAL TRAILS ON AVIAN COMMUNITIES. In: Abstracts from the Society of Conservation Biology Meeting. Dept. of Fishery and Wildlife Biology, Colorado State University, Fort Collins. 1995.
Note: new.
376. Moen, A. N., S. Whittemore, and B. Buxton. EFFECTS OF DISTURBANCE BY SNOWMOBILES ON HEART RATE OF CAPTIVE WHITE-TAILED DEER (*Odocoileus virginianus*). New York Fish and Game Journal 29(2):176-183. 1982.
Note: new.
377. Moen, A. N. ENERGY CONSERVATION OF THE WHITE-TAILED DEER IN THE WINTER. Ecology; 57(1):102-198. 1976.
Analyzes energy-conserving behavioral adaptations of white-tailed deer in northwestern Minnesota during winter. Energy conservation of up to 1,000 Kcal/day for a 60 kg deer can result from reduced activity levels (seeking level land and lesser snow depth, walking slowly, etc.). Winter harassment by dogs or snowmobile traffic is detrimental to these adaptations (Ream 1980).

378. Moen, A. N. SEASONAL CHANGES IN HEART RATES, ACTIVITY METABOLISM, AND FORAGE INTAKE OF WHITE-TAILED DEER. J. Wildl. Manage.; 42(4):715-738. 1978.
White-tailed deer exhibited seasonal rhythms in heart rates, activities, and metabolism, with the lowest ecological metabolism occurring in the winter and highest in the summer. This rhythm is an adaptation for energy conservation; resource needs are lower when range resources are reduced. As metabolism rises in March and April, the intake of dormant forage should also rise until more digestible spring growth is available. The timing of the arrival of spring seems to be an important factor in population dynamics, with its effect being more pronounced 2 years later when the fawns should become members of the breeding population.

379. Montana Department of Fish, Wildlife and Parks. PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT. Montana Snowmobile Grant Program. Prepared by Statewide Trails Program Coordinator, Montana Dept. of Fish, Wildlife and Parks, 1420 E. Sixth Ave., Helena, Mont. 59620. 1993.
Note: new.

380. Montopoli, G. L. and D. A. Anderson. LOGISTICAL MODEL FOR THE CUMULATIVE EFFECTS OF HUMAN INTERVENTION ON BALD EAGLE HABITAT. Jour. Wildl. Manage. 55:290-293. 1991.
Note: new.

381. Morgantini, L. E.; and R. J. Hudson. HUMAN DISTURBANCE AND HABITAT SELECTION IN ELK. in: Symposium on Elk Ecology and Management, pp. 132-139; Laramie, WY. 1978 Apr 3.
Habitat selection by elk was not simply related to weather conditions or available food. Passive harassment resulting from human activities (vehicular and hunting) reduced elk use of open grassland (transected by roads) and caused overgrazing of marginal areas (away from roads). This may be especially hard on elk during severe winters when energy budgets are stressed (Ream 1980).

382. Morrison, J. R. EFFECTS OF SKI AREA EXPANSION ON ELK AND ACCURACY OF TWO TELEMETRY SYSTEMS IN MOUNTAINOUS TERRAIN. M. S. Thesis, Colorado State University, Fort Collins, Colo. 98 pp. 1992.
Note: new.

383. Murphy, J. R. NEST SITE SELECTION BY THE BALD EAGLE IN YELLOWSTONE NATIONAL PARK. Utah Acad. Sci. Arts Let. Proc. ; 42:261-264. 1965.
Along with proximity to water and food sources, human disturbance is suggested as an important factor determining bald eagle nest site selection in Yellowstone National Park. Instances of apparent disruption of bald eagle nesting by human intrusions are cited.

384. National Park Foundation. NATIONAL PARKS FOR THE 21st CENTURY-THE VAIL AGENDA. Report and recommendations to the Director of the National Park Service. Capital City Press, Montpelier, VT. 1992.

385. Neil, P. H.; R. W. Hoffman; and R. B. Gill. EFFECTS OF HARASSMENT ON WILD ANIMALS—AN ANNOTATED BIBLIOGRAPHY OF SELECTED REFERENCES. Colorado Division of Wildlife; Special Rep. No. 37, Denver. 21 pp. 1975.
Annotated Bibliography: This is a compilation of 68 annotated references dealing with the many forms of harassment of wild mammals and birds in their natural habitats. Emphasis in this bibliography is principally on the effects of off-the-road vehicles, free-roaming pets, urbanization and other habitat alterations, and hunting.

386. Nelson, M. E.; and L. D. Mech. RELATIONSHIP BETWEEN SNOW DEPTH AND GRAY WOLF PREDATION ON WHITE-TAILED DEER. J. Wildl. Manage.; 50(3):471-474. 1986.
Survival of 203 yearling and adult white-tailed deer was monitored for 23,441 deer days from January through April 1975-85 in northeastern Minnesota. Gray wolf predation was the primary mortality cause, and from year to year during this period, the mean predation rate ranged from 0.000 to 0.029. The sum of weekly snow depths/month explained 51% of the variation in annual wolf predation rate, with the highest predation during the deepest snow.

387. Nero, R. W. *THE GREAT GRAY OWL: PHANTOM OF THE NORTHERN FOREST. Smithsonian Institution Press,. 0167.

388. Neumann, P. W.; and H. G. Merriam. ECOLOGICAL EFFECTS OF SNOWMOBILES. Can. Field-Nat.; 86:207-212. 1972.
Studies in Ontario showed that snowmobiles caused significant changes in snow structure and wildlife behavior. Snowmobile use affected snowshoe hare and red fox mobility and distribution, and caused significant damage to browse plants (Boyle and Samson 1983).

389. Newby, F. E.; and P. L. Wright. *DISTRIBUTION AND STATUS OF THE WOLVERINE IN MONTANA. J. Mammal.; 36:248-253. 1955.

390. Newby, F. E.; and J. J. McDougal. *RANGE EXTENSIONS OF THE WOLVERINE IN MONTANA. J. Mammal.; 45:485-487. 1964.

391. Newton, I. *POPULATION ECOLOGY OF RAPTORS. Buteo Books, Vermillion, SD (397pp). 1979.

392. Norris, R. A. *COMPARATIVE BIOSYSTEMATICS AND LIFE HISTORY OF THE NUTHATCHES, SITTA PYGMAEA AND SITTA PUSILLA. Univ. Calif. Publ. Zool; 56:119-300. 1958.

393. Noss, R. F. and A. Y. Cooperrider. SAVING NATURE'S LEGACY: PROTECTING AND RESTORING BIODIVERSITY. Island Press, Washington, D.C. 1994.
Note: new.

394. Nyran, R. B.; and M. C. Jansson. PERCEPTION OF WILDLIFE HAZARD IN NATIONAL PARK USE. Trans. N. Am. Wildl. Nat. Resour. Cong.; 38:281-295. 1973.
Increased visitation to North American National Parks is resulting in more people-wildlife encounters, thus generating crucial management problems. Park management policies are subject to public opinions, which in turn depend on public perceptions. Results of a study to determine visitor perceptions of wildlife hazard in western National Parks are reported and management implications are discussed (Boyle and Sampson 1983).

395. Odum, E. P. TRENDS EXPECTED IN STRESSED ECOSYSTEMS. BioScience 35:419-422. 1985.
Note: new.

396. O'Farrell, M. J. *STATUS REPORT: EUDERMA MACULATUM. Report to USDI, U.S. Fish Wildl. Serv., Albuquerque. 28 pp. 1981.

397. O'Farrell, M. J.; and E. H. Studier. *MYOTIS THYSANODES. Mammalian Species No. 137. 5 pp. 1980.

398. O'Farrell, M. J.; and E. H. Studier. *REPRODUCTION, GROWTH AND DEVELOPMENT IN MYOTIS THYSANODES AND M. LUCIFUGUS (CHIROPTERA: VESPERTILIONIDAE). Ecology; 54:18-30.

399. Olsen, D. L.; D. R. Blankenship; R. C. Erickson; R. Drewien; H. D. Irby; R. Lock; and L. S. Smith. WHOOPING CRANE RECOVERY PLAN. USDI, U.S. Fish and Wildlife Service; Washington, D.C. 206 pp.
This recovery plan presents information on the history, biology, and status of the whooping crane, and detailed management plans aimed at restoring the whooping crane to nonendangered status. Among factors believed responsible for the near extinction of the species are various forms of indirect and direct human disturbance. Whoopers seem to tolerate some disturbance, but only for short periods of time and if no obvious threats occur (Boyle and Samson 1983).

400. Olson, S. T.; and W. Marshall. THE COMMON LOON IN MINNESOTA. Occasional Paper #5, Minnesota Mus. Nat. History, Univ. Minnesota Press, Minneapolis. 77 pp. 1952.

401. Olson, S. L.; and W. D. Edge. *NEST SITE SELECTION BY MOUNTAIN PLOVERS IN NORTHCENTRAL MONTANA. J. Range Manage.; 38:280-282. 1985.

402. Otvos, I. S. *ARTHROPOD FOOD OF SOME FOREST-INHABITING BIRDS. Can. Entomol.; 117:971-990. 1985.

403. Packard, J.; and L. D. Mech. *POPULATION REGULATION IN WOLVES. Pages 135-150 in: M. N. Cohen, R. S. Malpass, and H. G. Klein, eds. Biosocial mechanisms of population regulation. Yale University Press, New Haven. 406 pp. 1980.

404. Palmer, D. A. *HABITAT SELECTION, MOVEMENTS AND ACTIVITY OF BOREAL AND SAW-WHET OWLS. M.S. thesis; Colorado State Univ., Fort Collins. 101 pp. 1986.

405. Park, E. *THE WORLD OF THE OTTER. J. B. Lippencott, Philadelphia. 159 pp. 1971.

406. Parker, K. L.; C. T. Robbins; and T. A. Hanley. ENERGY EXPENDITURES FOR LOCOMOTION BY MULE DEER AND ELK. J. Wildl. Manage.; 48(2):474-488. 1984.
Energy expenditures for several activities were measured using indirect calorimentry with 5 mule deer and 8 elk. The average energetic increment of standing over lying was 25%. Net energy costs (kcal/kg/km) of horizontal locomotion without snow decreased as a function of increasing body weight. The average cost per kilogram for each vertical meter climbed on a 14.3 degree incline was 5.9 kcal. Efficiency of upslope locomotion averaged 40-45% for the two species; downslope efficiency decreased with increasing body size. Energy expenditures for locomotion in snow increased curvilinearly as a function of snow depth and density. To further understand the energetics of locomotion in snow, foot loading and leg length were measured. Management implications, based on

the costs of locomotion for mule deer and elk when disturbed by winter recreationists and when traversing the slash deposition of logging operations are discussed.

407. Pederson, R. J. MANAGEMENT AND IMPACTS OF ROADS IN RELATION TO ELK POPULATIONS. In: Conf. Proc. Recreational Impact on Wildlands, R. Ittner, D. R. potter, J. K. Agee, and S. Anschell, eds., pp. 169-173. U.S. Forest Serv., U.S. Natl. Park Serv. R-6-001-1979. 1979.
Note: new.
Construction of roads in elk habitat effectively eliminated prime areas from elk production.

408. Pedevillano, C. and R. G. Wright. INFLUENCE OF VISITORS ON MOUNTAIN GOAT ACTIVITIES IN GLACIER NATIONAL PARK. Biological Conservation 39:1-11. 1987.
Note: new.
Goats at mineral licks apparently not disturbed by visitors, but goats attempting to cross goat underpasses were negatively affected by numbers of vehicles on the highway.

409. Peek, J. and D. B. Siniff. WILDLIFE-SNOWMOBILE INTERACTION PROJECT: PROGRESS REPORT. Univ. Minnesota Dept. Entom., Fish, Wildl., Ecol. and Behav. Biol., and Minn. Dept. of Natural Resources, St. Paul. 1972.
Note: new.

410. Pelton, M. R. *BLACK BEAR (URSUS AMERICANUS). Pages 504-514 in: J. A. Chapman and G. A. Feldhamer, eds. Wild mammals of North America: biology, management, and economics. John Hopkins University Press, Baltimore. 1982.

411. Perkins, M. *THE PLIGHT OF PLECOTUS. Bats; 2:1-3. 1985.

412. Perry, C. and R. Overly. IMPACT OF ROADS ON BIG GAME DISTRIBUTION IN PORTIONS OF THE BLUE MOUNTAINS OF WASHINGTON, 1972-1973. Washington Game Department. 1976.
Note: new.
General reduction of use up to 1/8 mile from roads, depending on amount of roadside cover; deer substantially affected in meadows when cover was lacking.

413. Peters, R. P.; and L. D. Mech. *SCENT-MARKING IN WOLVES. American Scientist: 63:628-637. 1975.

414. Peterson, R. O. MANAGEMENT IMPLICATION OF WOLF-MOOSE RESEARCH, ISLE ROYALE NATIONAL PARK, MICH. Rept. to the Natl. Park Serv. 14 pp. 1977.
Wolves of Isle Royale tend to avoid contact with humans. Wolf use of park trails declines after visitors arrive in the spring. Selection of den and rendezvous sites indicates pronounces avoidance of humans. Management suggestions include limiting visitation, enlarging existing backcountry campsites rather than establishing new campgrounds, no further trail development, and discouragement of winter visitor use (Ream 1980).

415. Pomerantz, G. A.; D. J. Decker; G. R. Goff; and K. G. Purdy. ASSESSING IMPACT OF RECREATION ON WILDLIFE: A CLASSIFICATION SCHEME. Wildl. Soc. Bull.; 16:58-62. 1988.

416. Poole, A. THE EFFECTS OF HUMAN DISTRUBANCE ON OSPREY REPRODUCTIVE SUCCESS. Colon. Waterbirds; 4:20-27. 1981.
Effects of visits to osprey nests by researchers, trapping of breeding adults, and other human activities near nests were studied on the Atlantic coast from New York City to Boston, Massachusetts, and in Everglade National Park, Florida. No evidence was found of adverse effects of osprey reproduction from nest visits, although climbing nest trees may increase raccoon predation on young or eggs. Nests exposed to nearly continuos human activity produced young at rates equivalent to wilderness nests (Boyle and Samson 1983).

417. Potter, D. R.; K. M. Sharpe; and J. C. Hendee. HUMAN BEHAVIOR ASPECTS OF FISH AND WILDLIFE CONSERVATION: AN ANNOTATED BIBLIOGRAPHY. USDA, U.S. For. Ser. Gen. Tech. Rep. PNW-4. 288 pp. 1973.
Annotated Bibliography.

418. Powell, R. A. *THE FISHER-LIFE HISTORY, ECOLOGY AND BEHAVIOR. Univ. Minnesota Press, Minneapolis. 217 pp. 1982.

419. Progulske, D. R.; and T. S. Baskett. MOBILITY OF MISSOURI DEER AND THEIR HARASSMENT BY DOGS. J. Wildl. Manage.; 22(2):184-192. 1958.

420. Pruitt, W. O. SNOWMOBILES AND ALL-TERRAIN VEHICLES. Paper presented at Conference on Snowmobiles and All-Terrain Vehicles. Univ. of Western Ontario, Dept. Zool. Res. Report, University of Manitoba, Winnipeg, Canada. 1971.
Note: new.
Discussed impacts of snowmobiles on the subnivean environment.

421. Purdy, K. G., G. R. Goff, D. J. Decker, G. A. Pomerantz, and N. A. Connelly. GUIDE TO MANAGING HUMAN ACTIVITY ON NATIONAL WILDLIFE REFUGES. USDI Fish and Wildlife Service, Office of Information Transfer. Fort Collins, Colorado. 1987.
Note: new.

422. Purves, H. D.; C. A. White; and P. C. Paquet. WOLF AND GRIZZLY BEAR HABITAT USE AND DISPLACEMENT BY HUMAN USE IN BANFF, YOHO, AND KOOTENAY NATIONAL PARKS: A PRELIMINARY ANALYSIS. Heritage Resources Conservation, Canadian Parks Service, Banff, AB. 1992.
The SPANS Geographic Information System was used to analyze observations of radio collared wolves and grizzly bears. The value of existing habitat suitability models was tested for these two species, as well as the human displacement effect of varying intensities of human activity. Human activity levels were classified using an exponential scale of monthly traffic on human use vectors (roads and trails), or monthly person/days of use for human use points and polygons (campsites, towns, and ski areas).

Within Banff National Park (BNP) over 91% of the wolf telemetery observations occurred within ecosites rated as high and very high habitat capability. Most wolf observations were in the Bow Valley between Vermillion Lakes and Bow Lake and in the Spray Valley to Kananaskis Country. Wolves used the valley bottoms for travel corridors but showed aversion to regions where winter human use exceeded 10,000 visitors per month. The town of Banff has created a partial blockage to wolf movement denying wolves access to prime habitat east of the town.

Only 51% of the grizzly bear observations were in ecosites rated as high and very high capability within BNP, Yoho National Park (YNP), and Kootenay National Park (KNP). Of ten radio collared bears, four were habituated to humans, and therefore removed from future data analysis. Grizzly bear tolerance to human use was found to be within the range of 1,001-10,000 visitors per month. In the three parks, 335 square kilometers of available habitat were found to have use levels which exceeded the tolerance of non-habituated bears.

Given the displacement of wolves and grizzly bears by current human use levels in BNP, YNP, and KNP, and forecasted increases in visitation to these parks, management of human use is essential if humans, wolves, and grizzly bears are to continue to coexist. An objective of "no-net-loss" for carnivore habitat must be accepted by the Canadian Parks Service (CPS). A possible management strategy is to accommodate increased human activity in areas where wolves and grizzly bears have been totally displaced, and discourage increased human use of areas still used by these carnivores. In all cases, carnivore migration corridors must be preserved or widespread habitat alienation can occur.

As part of cumulative effects management, knowledge of displacement must be integrated with other factors that affect the survival of wolves and grizzly bears in the Canadian Rockies. It is recommended that a standing Environmental Assessment and Review Process (EARP) Panel should be established immediately to ensure that cumulative effects are recognized in preserving carnivores in YNP, KNP, and BNP.

423. Quinn, N. W. S.; and G. Parker. *LYNX. Pages 682-695 in: M. Novak, J. A. Baker, M. E. Obbard, and B. Malloch, eds. Wild furbearer management and conservation in North America. Ministry of Natural Resources, Ontario. 1987.

424. Rabb, G. B. *REPRODUCTIVE AND VOCAL BEHAVIOR IN CAPTIVE PUMAS. J. Mammal.; 40:616-617. 1959.

425. Rapport, D. J., H. A. Regier, and T. C. Hutchinson. ECOSYSTEM BEHAVIOR UNDER STRESS. American Naturalist 125:617-640. 1985.
Note: new.

426. Ream, C. H. HUMAN-WILDLIFE CONFLICTS IN BACKCOUNTRY: POSSIBLE SOLUTIONS. Page 153-163 in: R. Ittner, D. R. Potter, J. K. Agee, and S. Anschell, eds. Recreational impacts on wildlands. Conf. Proc., 27-29 October 1978, Seattle, WA. U.S. For. Serv. R-6-001-1979. 1979.
Increasing backcountry recreational use and diminishing wildlands contribute to growing pressures on wildlife in backcountry areas. The extent of human impacts and possible solutions are reviewed. Deliberate harassment sometimes occurs, but the major impact of humans on wildlife results from unintentional disturbance. Management of people, wildlife, and habitat may be necessary to reduce human-wildlife conflicts (Boyle and Samson 1983).

427. Ream, C. H. IMPACT OF BACKCOUNTRY RECREATIONISTS ON WILDLIFE: AN ANNOTATED BIBLIOGRAPHY. USDA, U.S. For. Serv. Gen. Tech. Rep. INT-84. 1980.
*Annotated Bibliography.

428. Redmond, R. L.; and D. A. Jenni. *NATAL PHILOPATRY AND BREEDING AREA FIDELITY OF LONG-BILLED CURLEWS: PATTERNS AND EVOLUTIONARY CONSEQUENCES. Behavioral Ecology and Sociobiology; 10:277-279. 1982.

429. Redmond, R. L.; and D. A. Jenni. *POPULATION ECOLOGY OF LONG-BILLED CURLEWS IN WESTERN IDAHO. Auk; 103:755-767. 1986.

430. Regelin, W. L., C. C. Schwartz, and A. W. Franzmann. SEASONAL ENERGY METABOLISM IN MOOSE. J. Wildl. Manage. 49:388-393. 1985.
Note: new.

431. Reid, M.; R. Mule; and B. Renfrow. ASSESSMENT OF GRIZZLY BEAR UTILIZATION AND HABITAT QUALITY IN THE CLARK'S FORK SNOWMOBILE TRAIL CORRIDOR. Prep. for Douglas Hart B-4 Ranch. Prep. by KRA Nat. Resour. Consultants, Bozeman, MT. 54 pp. 1983.

432. Reid, N. J. PUBLIC VIEW OF WILDLIFE. Pages 77-80 in: Towards a new relationship of man and nature in temperate lands. Part 1: Ecological impact of recreation and tourism upon temperate environments. IUCN Tenth Technical Meeting, 26-30 June 1966, Lucerne, Switzerland, IUCN Publ. New Serv. 7, Morges, Switzerland. 1967.
Techniques for providing public viewing of wildlife in U.S. National Parks are discussed. Sound ecological management of parks resources can greatly improve wildlife viewing, and special viewing facilities and devices are suggested for increasing viewing opportunities. Park roads are often major viewing points in National Parks. Visitors should be encouraged to adjust their schedules to take advantage of seeing wildlife at their most active times (Boyle and Samson 1983).

433. Reinecke, K.; and D. Delnicki. DUCKDATA; A BIBLIOGRAHIC DATA BASE FOR NORTH AMERICAN WATERFOWL (ANATIDAE) AND THEIR WETLAND HABITATS. USDI, U.S. Fish Wildl. Ser. Res. Pub. 188. 1992.
*Annotated Bibliography (available from authors on formatted user-supplied diskettes in ProCite format, contains some 9,000 citations).

434. Renecker, L. A. and R. J. Hudson. SEASONAL ENERGY EXPENDITURES AND THERMOREGULATORY RESPONSES OF MOOSE. Can. Jour. Zoology 64:322-327. 1986.
Note: new.

435. Richens, V. B.; and G. R. Lavigne. RESPONSE OF WHITE-TAILED DEER TO SNOWMOBILES AND SNOWMOBILE TRAILS IN MAINE. Can. Field-Nat.; 92:334-344. 1978.
Studies of deer responses to snowmobiles in Maine revealed that deer were not driven from the area by snowmobiles and frequently followed snowmobile trails where the snow was firmer. It is suggested that snowmobiles could be used to manage deer in winter by providing trails where walking in snow is easier and inducing winter movements to suitable habitat (Boyle and Samson 1983).

436. Rocky Mountain/Southwestern Recovery Team. *AMERICAN PREGRINE FALCON RECOVERY PLAN (ROCKY MOUNTAIN, SOUTHWEST POPULATIONS). U.S. Fish Wildl., Denver, CO. 183 pp. 1977.

437. Roggenbuck, J. W. USE OF PERSUASION TO REDUCE RESOURCE IMPACTS AND VISITOR CONFLICTS. In: Influencing Human Behavior, M. J. Manfredo, ed., pp. 149-208. Sagamore Publishing, Inc. Champaign, Ill. 1992.
Note: new.

438. Rolley, R. E. *BOBCAT. Pages 670-681 in: M. Novak, J. A. Baker, M. E. Obbard, and B. Malloch, eds. Wild furbearer management and conservation in North America. Ministry of Natural Resources, Ontario. 1987.

439. Rongstad, O. J. RESEARCH NEEDS ON ENVIRONMENTAL IMPACTS OF SNOWMOBILES. In: Off-road Vehicle Use: A Management Challenge, N. Andrews, L. Richard, and P. Nowak, eds., USDA Ofc. of Environmental Quality. Washington, D.C. 1980.
Note: new.

440. Rosenmann, M. and P. Morrison. PHYSIOLOGICAL CHARACTERISTICS OF THE ALARM REACTION IN THE DEER MOUSE. Physiological Zoologica 47:230-241. 1974.
Note: new.

441. Rost, G. A. and J. A. Bailey. DISTRIBUTION OF MULE DEER AND ELK IN RELATION TO ROADS. J. Wildl. Manage. 43:634-641. 1979.
Note: new.

442. Rost, G. R. RESPONSE OF DEER AND ELK TO ROADS. M.S. thesis; Colorado State University, Fort Collins. 51 pp. 1975.
Responses of deer and elk to roads on winter ranges in Colorado were studied by counting fecal pellet groups along transects perpendicular to roads. Deer and elk apparently avoided areas near roads, particularly areas within 200 meters of roads. Deer avoided even dirt roads, some of which were used only by four-wheel drive vehicles, trailbikes, and hikers (Boyle and Samson 1983).

443. Rost, G. R.; and J. A. Bailey. RESPONSES OF DEER AND ELK TO ROADS ON THE ROOSEVELT NATIONAL FOREST. Dept. Fish and Wildl. Biol., Colo. St. Univ., Ft. Collins. 19 pp. (mimeo). 1974.
In the mountain shrub and ponderosa pine vegetation zones on the Roosevelt National Forest, Colorado, deer and elk pellet-groups densities increased with distance from roads. Deer avoidance of roads was greater in the ponderosa pine zone. Paved, gravel and unimproved dirt roads were avoided. Limited data for elk indicated that elk avoid gravel roads but not dirt roads, which are usually snowbound when elk are present, in the ponderosa pine zone. It is not known if deer or elk will avoid roads to an extent that is detrimental to their welfare (Neil et al. 1975).

444. Ruggiero, L. F., G. D. Hayward, and J. R. Squires. VIABILITY ANALYSIS IN BIOLOGICAL EVALUATIONS: CONCEPTS OF POPULATION VIABILITY ANALYSIS, BIOLOGICAL POPULATION, AND ECOLOGICAL SCALE. Conservation Biology 8(2):364-372. 1994.
Note: new.
Reviewed population viability analysis (PVA). Suggested that assessments must address population persistence and habitat dynamics. A 7-step guide for PVA was provided.

445. Russell, D. OCCURRENCE AND HUMAN DISTURBANCE SENSITIVITY OF WINTERING BALD EAGLES ON THE SAUK AND SUIATTLE RIVERS, WASHINGTON. In: Proceedings of Washington Bald Eagle Symposium, R. L. Knight, G. T. Allen, M. V. Stalmaster, and C. W. Servheen, eds., pp. 165-174. 1980.
Note: new.

446. Sachet, G. A. INTEGRATED TRAIL PLANNING GUIDELINES FOR WILDLIFE, RECREATION AND FISH RESOURCES ON MT. HOOD NATIONAL FOREST. USDA Forest Service. 1990.
Note: new.

447. Saltz, D.; and G. C. White. URINARY CORTISOL AND UREA NITROGEN RESPONSES TO WINTER STRESS IN MULE DEER. J. Wildl. Manage.; 55(1):1-16. 1991.
The authors investigated the urinary cortisol and urea nitrogen responses of mule deer in winter population densities. Urine cortisol, assumed to reflect energy deficit, allows researchers to distinguish high levels of urea nitrogen caused by the availability of crude protein from those caused by muscle catabolism. The authors concluded that by reflecting both environmental and animal condition, urine cortisol provides a tool for assessing population condition and ecological density.

448. Salwasser, H. and F. Samson. CUMULATIVE EFFECTS ANALYSIS: AN ADVANCE IN FOREST PLANNING AND WILDLIFE MANAGEMENT. Tran. No. Amer. Wildl. and Nat. Res. Conf. 50:313-321. 1985.
Note: new.

449. Salwasser, H., C. Schoenwald-Cox, and R. Baker. ROLE OF INTERAGENCY COOPERATION IN MANAGING FOR VIABLE POPULATIONS. In: Viable Populations for Conservation, M. E. Soule, ed., pp. 159-173. Cambridge University Press. 1972.
Note: new.

450. Samuel, M. D. and R. E. Green. A REVISED TEST PROCEDURE FOR IDENTIFYING CORE AREAS WITHIN THE HOME RANGE. J. An. Ecology 57:1067-1068. 1988.
Note: new.
Revised his 1985 paper in same journal.

451. Schaller, G. B. *THE BREEDING BEHAVIOR OF THE WHITE PELICAN AT YELLOWSTONE LAKE, WYOMING. Condor; 66(1):3-23. 1964.

452. Schleyer, B. O. ACTIVITY PATTERNS OF GRIZZLY BEARS IN THE YELLOWSTONE ECOSYSTEM AND THEIR REPRODUCTIVE BEHAVIOR, PREDATION, AND USE OF CARRION. M. S. thesis, Montana State Univ., Bozeman. 1983.
Note: new.

453. Schmid, W. D. MODIFICATION OF THE SUBNIVEAN MICROCLIMATE BY SNOWMOBILES. In: Snow and Ice in Relation to Wildlife and Recreation, Symposium Proceedings, pp. 251-257. Coop. Wildl. Res. Unit, Iowa State Univ., Ames. 1971.
Note: new.

454. Schmid, W. D. SNOWMOBILE ACTIVITY, SUBNIVIAN MICROCLIMATE AND WINTER MORTALITY OF SMALL MAMMALS. Bull. Ecol. Soc. Am.; 53(2):37 (Abstract only).
Compaction of snowfields by snowmobiles alters the mild snow microclimate, potentially affecting organisms that live within or beneath the snow by increasing temperature stress or restricting movement. Experimental manipulation of a snowfield showed that winter mortality of small mammals was significantly increased by snowmobile compaction (Boyle and Samson 1983).

455. Schullery, P. *THE BEARS OF YELLOWSTONE. Yellowstone Library and Museum Assoc., Yellowstone National Park, WY. 176 pp. 1980.

456. Schultz, R. D. RESPONSES OF NATIONAL PARK ELK TO HUMAN ACTIVITY. M.S. thesis. Univ. of Montana. 95 pp. 1975.
Note: new.

457. Schultz, R. D.; and J. A. Bailey. RESPONSES OF NATIONAL PARK ELK TO HUMAN ACTIVITY. J. Wildl. Manage.; 42(1):91-100. 1978.
Responses of elk to human activities near a road were quantified for fall, winter, and spring in Rocky Mountain National Park. These elk, which experienced little or no hunting, were not significantly affected by normal on-road visitor activities (Ream 1980).

458. Scom, A. J., G. Bollinger, and O. J. Rongstad. STUDYING THE EFFECTS OF SNOW-MOBILE NOISE ON WILDLIFE. Internoise Proceedings 236-241. 1972.
Note: new.

459. Scott, P.; and the Waterfowl Trust. *THE SWANS. Houghton Mifflin, Boston. 242 pp. 1972.

460. Seidensticker, J. C., IV; M. G. Hornocker; W. C. Wiles; and J. P. Messick. *MOUNTAIN LION SOCIAL ORGANIZATION IN THE IDAHO PRIMITIVE AREA. Wildl. Monogr. No. 35:1-60. 1973.

461. Serveen, C. W. ECOLOGY OF THE WINTERING BALD EAGLES ON THE SKAGIT RIVER, WASHINGTON. M.S. thesis; University of Washington, Seattle. 96 pp. 1975.
Bald eagle distributions in winter on the Skagit River, Washington, were related to habitat factors including human activity. Eagles initially utilized areas isolated from a road and receiving little human use, and only when food became less available in these areas were areas with more human activity utilized (Boyle and Samson 1983).

462. Several. SNOWMOBILES VERSUS WOLVES. International Wolf. 1992 Mar.
In response to the concern that snowmobile use may be harmful to wolf survival, the staff of “International Wolf” polled 40 wolf biologists with the question, “do you believe that snowmobiles are harmful to wolves in any way other than to provide accessibility to kill or harass them?” Excerpts from the seventeen biologists who responded are as follows:

Anonymous: “Snowmobile traffic may benefit wolves by packing the snow and allowing more efficient travel, particularly in deep snow. This probably allows more packs to travel their territories more rapidly, hunt more effectively, and advertise their territory (via scent marking and howling) more effectively. However, there must be some level of snowmobile traffic at which disturbance becomes detrimental. This may be 5 to 100 times the current level within wolf territories, but undoubtedly there exists some threshold at which the network of snowmobile trails and frequency of passage of snowmobiles would preclude wolf occupancy.”

Berg, B., Wildlife Biologist, Department of Natural Resources, Minnesota: “Unless a snowmobiler is hell-bent on killing a wolf, snowmobiles traveling on established trails likely have little or no adverse impacts on wolves. Rather, snowmobiles trails may help both wolves and deer by providing ease of access to other habitats and food sources. Most snowmobile trails and secondary roads in Minnesota have wolf tracks on them, and many wolf pack territories in northern Minnesota contain or border on snowmobile trails.

With Minnesota's wolf population stable to slightly increasing, there is no reason to believe that average snowmobile traffic on established trails has any adverse effect."

Burch, J. Denali National Park, Alaska: "Wolves are smart, tough, adaptive animals both as individuals and as a species. There are several observations from both Alaska and Minnesota of wolves becoming accustomed to mechanized equipment. Wolves have proved their ability to deal with these disturbances and go on about their business as though they did not exist."

Darby, W. R. Ministry of Natural Resources, Ontario, Canada: "Snowmobile trails probably benefit wolves by making travel and access to prey easier."

Fuller, T. Asst. Prof., University of Massachusetts: "It seems clear that when no harassment is involved, and when the presence of vehicles does not otherwise disrupt normal behaviors, such vehicles likely are not harmful. However loud and unaesthetic snowmobiles may be to some people, wolves likely can adapt to them as long as there is no direct influence on behavior or survival."

Haber, G., Wildlife Scientist, Denali Park, Alaska: If there are wolves in the area, there could be unintentional harassment. If there is a snow machine buzzing around them, wolves are likely to exit that immediate area, at least temporarily, whether the driver is intentionally after them or not."

Herbert, D., Integrated Environmental Resource Manger, Alberta-Pacific Forest Industries, Inc., Canada: "Depending on the density of snowmobile activity and the size of the habitat area, I believe that most animals can accommodate this activity with short movements. Obviously, there is an activity level, even without harassment, that would limit accommodating movements".

"Although some evidence shows a change in [wolves] physiological response (heart rate), it has not been translated to increased mortality, body weight loss, etc. It is highly unlikely that this activity will affect wolf survival. It certainly won't in Canada. There is a possibility it might in Minnesota. However, if snowmobile activity reaches that level, it probably isn't safe for humans either."

Kunkel. K. E., Graduate Research Assistant, University of Montana: "As long as the miles of trails in a given area don't reach a density where security cover for wolves is greatly diminished, the impact should be minimal. What this trail density is, is probably unknown, but I can think of no trail system in the northeastern portion of Minnesota where it is excessive and can't imagine such a system developing and being consistently used."

Mech, L. D., Wolf Biologist, National Biological Survey, Minnesota: "In my experience, wolves readily adapt to traffic and noise of snowmobiles just as they do to those of vehicles. I know of many wolf pack territories through which snowmobiles pass regularly every winter and have never seen any evidence of harm to wolves from them."

Nelson. M., Wildlife Research Biologist, U.S. Fish and Wildlife Service, Minnesota: "Except for providing human accessibility to wolves, snowmobiles seem to present no direct threat to wolves. My observations of wolves in forested habitat indicate that wolves appear indifferent to snowmobile traffic that is not close to them (*i.e.,* farther away that 100-220 yards). This is the same apparent indifference wolves display toward vehicular traffic, heavy machinery and walking humans at similar distances."

Meier, T., Denali National Park, Alaska: I'm disturbed by the tendency to use wolves to promote other agendas. The result is usually a backlash against wolves and, more insidiously, a damage to the perception of wolves and natural systems in the minds of their strongest supporters. Wolves are not fragile losers who need our every effort to help them survive. They and their societies are robust and adaptable. If we refrain from killing them and allow them some prey to eat, they will thrive."

Peterson, R., Professor, School of Forestry and Wood Products, Michigan Technological University: "Wolves might avoid corridors used heavily by snowmobiles. One might expect this to be especially important where wolves are hunted/trapped. I am aware of no evidence that this is true, but such evidence is not easily obtained. Such avoidance, if it occurs, might not be important to a local wolf population, depending on distribution and abundance of prey. On the other hand, it is just as likely that wolves would utilize snowmobile trails for travel routes. Whether that might be beneficial or harmful to their long-term persistence is another open question."

Thiel, D., Coordinator, Sandhill Outdoor Skills Center, Department of Natural Resources, Wisconsin: "As our Cessna plane circled 300 feet above the snowy forest, I witnessed three members of the radioed Boot-jack pack nonchalantly devouring a deer, while within 300 feet, 15 snowmobilers passed by on an established trail. The "kill" was actually an unretrieved kill made two months earlier by a deer hunter, which the wolves had dug up and salvaged. Far from being intrusive, snowmobiles are simply a part of the wolves' winter environment and wolves deal with them as the circumstances dictate."

Wydeven, A., Wildlife Technician, Department of Natural Resources, Wisconsin: "In Wisconsin, we don't feel that normal traffic along designated trails probably has much effect on wolves. Travel off trails and near den sites in late winter may be more of a problem. Snowmobile traffic should probably be evaluated in relationship to road access concerns; where road densities (including snowmobile trails) become too high (one mile of road per square mile of land), the ability of wolves to exist will decline."

463. Severinghaus, C. W.; and B. F. Tullar. WINTERING DEER VERSUS SNOWMOBILES. Conservationist; 29(6):31. 1975.
Potential and observed effects of snowmobiles on wintering deer are discussed. Studies are cited in which deer were observed fleeing from approaching snowmobiles from as far as three quarters of a mile. Energy expenditure calculations demonstrate the danger of snowmobile harassment to deer already hard-pressed by winter conditions. Snowmobiles should not be permitted in deer wintering areas, and established trails should be kept at least one half mile from such areas (Boyle and Samson 1983).
464. Shaffer, M. L. MINIMUM VIABLE POPULATIONS COPING WITH UNCERTAINTY. In: Viable Populations for Conservation, M. E. Soule, ed., pp. 69-86. Cambridge University Press, Cambridge. 1987.
Note: new.
465. Shaffer, M. L. POPULATION VIABILITY ANALYSIS. Conservation Biology 4(1):39-40. 1990.
Note: new.
466. Shaffer, M. L. POPULATION VIABILITY ANALYSIS. In: Challenges in Conservation of Biological Resources: A Practioner's Guide, D. Decker et al., eds., pp. 107-119. Westview Press, San Francisco, Calif. 1992.
Note: new.
467. Shea, D. S. A MANAGEMENT-ORIENTED STUDY OF BALD EAGLE CONCENTRATIONS IN GLACIER NATIONAL PARK. M.S. thesis; University of Montana, Missoula. 78 pp. 1973.
Observations of bald eagles congregating in Glacier National Park, Montana, revealed that the greatest threat to eagles in the park was disturbance caused by park visitors. Management recommendations include the protection of certain areas from visitor disturbance such as snowmobiling and boating, and the establishment of designated areas where viewing and photography can be managed (Boyle and Samson 1983).
468. Shea, R. E. ECOLOGY OF THE TRUMPETER SWAN IN YELLOWSTONE NATIONAL PARK AND VICINITY. M. S. thesis. Univ. of Montana. 132 pp. 1979.
Note: new.
469. Shoesmith, M. W. SEASONAL MOVEMENTS AND SOCIAL BEHAVIOR OF ELK ON MIRROR PLATEAU, YELLOWSTONE NATIONAL PARK. In: North American Elk: Ecology, Behavior and Management, M. S. Boyce and L. D. Hayden-Wing, eds., pp. 166-176. Univ. of Wyoming, Laramie. 1980.
Note: new.
470. Short, L. L. *HABITATS AND INTERACTIONS OF NORTH AMERICAN BLACK-BACKED WOODPECKERS. American Museum Novitates No. 2547:1-42. 1979.
471. Short, L. L. *HABITS AND INTERACTIONS OF NORTH AMERICAN THREE-TOED WOODPECKERS. American Museum Novitates No. 2547:1-42. 1979.
472. Short, L. L. *WOODPECKERS OF THE WORLD. Delaware Museum of Natural History, Greenville, DE. 676 pp. 1982.

473. Shult, M. J. AMERICAN BISON BEHAVIOR PATTERNS AT WIND CAVE NATIONAL PARK. Ph.D. Diss. Iowa State University, Ames. 191 pp. 1972.
Encounters with humans resulted in various responses by bison depending on the degree of harassment. Examples of possible effects of bison behavior on the American Indians of the Great Plains are presented (Boyle and Samson 1983).

474. Shultz, R. D.; and J. A. Bailey. RESPONSES OF NATIONAL PARK ELK TO HUMAN ACTIVITY. J. Wildl. Manage.; 42(1):91-100. 1978.
Responses of elk to human activities near a road were quantified for fall, winter and spring in Rocky Mountain National Park. These elk, which experienced little or no hunting, were not significantly disturbed by normal on-road visitor activities (Ream 1980),.

475. Sidhu, S. S.; and A. B. Case. A BIBLIOGRAPHY ON THE ENVIRONMENTAL IMPACT OF FOREST RESOURCE ROADS: A LIST. Newfoundland forest Research Centre, St. Johns, Info. Rep. N-X-149. 28 pp. 1977.
Bibliography.

476. Simberloff, D. and J. Cox. CONSEQUENCES AND COSTS OF CONSERVATION CORRIDORS. Conserv. Biol. 1:63-71. 1987.
Note: new.

477. Simberloff, D. and L. G. Abele. REFUGE DESIGN AND ISLAND BIOGEOGRAPHIC THEORY: EFFECTS OF FRAGMENTATION. Am. Nat. 120:41-50. 1987.
Note: new.

478. Singer, F. BEHAVIOR OF MOUNTAIN GOATS, ELK, AND OTHER WILDLIFE IN RELATION TO U.S. HIGHWAY 2, GLACIER NATIONAL PARK. Glacier National Park, West Glacier, MT. 96 pp. 1975.
Behavior, habitat use, and disturbance of elk, mountain goats, and other wildlife were studied in relation to a highway in Glacier National Park, Montana. Habituation to the highway made elk more vulnerable to poaching. Mountain goat-human interactions occurred frequently near a salt lick; goat reactions were avoidance of and/or flight from humans. Highway design and construction are discussed (Boyle and Samson 1983).

479. Singer, F. J. BEHAVIOR OF MOUNTAIN GOATS IN RELATION TO HIGHWAY 2, GLACIER NATIONAL PARK, MONTANA. J. Wildl. Manage.; 42(3):591-597. 1978.
A study was conducted in 1975 on mountain goats crossing a highway to visit a mineral lick in Glacier National Park, Montana. Collision hazards and high disturbance during crossings suggested that a goat crossing should be constructed and visitors should be restricted from the crossing area (Boyle and Samson 1983).

480. Singer, F. J. and J. B. Beattie. CONTROLLED TRAFFIC SYSTEM AND ASSOCIATED RESPONSES IN DENALI NATIONAL PARK. Arctic 39:195-203. 1986.
Note: new.
Moose were more alert to vehicle traffic than were caribou.

481. Singer, F. J. SOME PREDICTIONS CONCERNING A WOLF RECOVERY INTO YELLOWSTONE NATIONAL PARK: HOW WOLF RECOVERY MAY AFFECT PARK VISITORS, UNGULATES AND OTHER PREDATORS. Trans. N. Am. Wildl. Nat. Resour. Conf.; 57:567-583. 1991.

482. Skagen, S. K. BEHAVIORAL RESPONSES OF WINTERING BALD EAGLES TO HUMAN ACTIVITY ON THE SKAGIT RIVER, WASHINGTON. In: Proceedings of the Washington Bald Eagle Symposium, R. L. Knight et al., eds. The Nature Conservancy. 1980.
Note: new.
483. Skagen, S. K.; R. L. Knight; and G. H. Orians. HUMAN DISTURBANCE OF AN AVIAN SCAVENGING GUILD. Ecol. Appl.; 1:215-225. 1991.
484. Skiba, G. T. ECOLOGICAL EVALUATION OF THE DINOSAUR NATIONAL MONUMENT BIGHORN SHEEP HERD. M.S. thesis; Colorado State University, Fort Collins. 107 pp. 1981.
Human disturbance is one of several factors discussed relating to bighorn sheep ecology in Dinosaur National Monument, Colorado/Utah. An apparent sheep population decline has coincided with an increase in whitewater rafting through important sheep habitat, but observations suggest that sheep are not seriously disturbed by people on foot or in rafts. Management recommendations include considerations for location of campsites to minimize sheep disturbance (Boyle and Samson 1983).
485. Smith, A. T. and M. M. Peacock. CONSPECIFIC ATTRACTION AND THE DETERMINATION OF METAPOPULATION COLONIZATION RATES. Conservation Biology 4:320-323. 1990.
Note: new.
Recolonization of habitats after disturbance.
486. Snyder, H. A.; and N. F. R. Snyder. INCREASED MORTALITY OF COOPER'S HAWKS ACCUSTOMED TO MAN. Condor: 76:215-216. 1974.
Recovery patterns from 235 banded Cooper's hawk nestlings suggest that familiarity with man renders a hawk more likely to die from predation by man, especially shooting. Birds with frequent exposures to man from banding activities or observation from blinds were recovered more frequently after being killed by humans than birds with little exposure to man; such birds apparently have less fear of humans and are more vulnerable to human predation (Boyle and Samson 1983).
487. Soule, M. E. and D. Simberloff. WHAT DO GENETICS AND ECOLOGY TELL US ABOUT THE DESIGN OF NATURE RESERVES? Biol. Conservation 35:19-40. 1986.
Note: new.
488. Stace-Smith, R. MISUSE OF SNOWMOBILES AGAINST WILDLIFE IN CANADA. Nat. Can. 494):3-8. Ottawa. 1975.
Note: new.
489. Stalmaster, M. V. and J. A. Gessaman. ECOLOGICAL ENERGETICS AND FORAGING BEHAVIOR OF OVERWINTERING BALD EAGLES. Ecological Monographs 54:407-428. 1984.
Note: new.
High levels of human disturbance during winter could increase energy demands and result in increased mortality rates.
490. Stalmaster, M. V., J. K. Kaiser, and S. K. Skagen. EFFECTS OF RECREATIONAL ACTIVITY ON FEEDING BEHAVIOR OF WINTERING BALD EAGLES. J. Raptor Research 27(1):93. 1983.
Note: new.

491. Stalmaster, M. V.; and J. R. Newman. BEHAVIORAL RESPONSES OF WINTERING BALD EAGLES TO HUMAN ACTIVITY. J. Wildl. Manage.; 42(3):506-513. 1978.
Tolerance of wintering bald eagles in Washington to disturbance was determined by relating eagle distributions to human activity and measuring flight distances of eagles from simulated human disturbances. Human activity had adverse effects on eagle distribution and behavior. Management recommendations aimed at reducing human-caused disturbance are suggested (Boyle and Samson 1983).

492. Stalmaster, M. V.; and R. G. Plettner. DIETS AND FORAGING EFFECTIVENESS OF BALD EAGLES DURING EXTREME WINTER WEATHER IN NEBRASKA. J. Wildl. Manage.; 56(2):355-367. 1992.
The authors studied the diets and foraging efficiency of bald eagles on a system of reservoirs and canals adjacent to, and including a portion of, the Platte River System during extreme weather and extensive ice cover in southwestern Nebraska in 1989. Hunting, piracy, and scavenging comprised 87, 9, and 4% of 1,395 foraging attempts, respectively. Foraging opportunities and efficacy were enhanced by the maintenance of ice-free waters by hydroelectric and steam-plant operations, and by the disabling of prey by hydroelectric facilities. Adults were more effective foragers than subadults. The authors conclude that, with proper maintenance, power-generating facilities can benefit wintering eagles by providing foraging opportunities during periods of potential energy stress.

493. Stalmaster, M. V.; J. L. Kaiser and S. K. Skagen. EFFECTS OF RECREATIONAL ACTIVITY ON FEEDING BEHAVIOR OF WINTERING BALD EAGLES. J. Raptor Res.; 27(1):93. 1993.

494. Stankey, G. H., D. N. Cole, R. C. Lucas, M. E. Peterson, and S. S. Frissell. LIMITS OF ACCEPTABLE CHANGE (LAC) SYSTEM FOR WILDERNESS PLANNING. General Technical Report INT-176. USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, Utah. 1985.
Note: new.
Follows carrying capacity concepts (no set number of visitors). Sets quantifiable standards of impact levels that trigger management actions.

495. Stankey, G. H.; and D. W. Lime. RECREATIONAL CARRYING CAPACITY: AN ANNOTATED BIBLIOGRAPHY. USDA, U.S. For. Serv. Gen. Tech. Rep. INT-3. 45 pp. 1973.
*Annotated Bibliography.

496. Stemp, R. E. HEART RATE RESPONSES OF BIGHORN SHEEP TO ENVIRONMENTAL FACTORS AND HARASSMENT. M. S. Thesis, Univ. of Calgary, Alberta, Canada. 371 pp. 1983.
Note: new.

497. Stenzel. L. E.; H. R. Huber; and G. W. Page. *FEEDING BEHAVIOR AND DIET OF THE LONG-BILLED CURLEW AND WILLET. Wilson Bull.; 88:314-332. 1976.

498. Stephenson, R. O. CHARACTERISTICS OF WOLF DEN SITES. Alaska Dept. Fish Game Project W-017-R-06/WP14/J06/FIN. 29 pp. 1974.
Studies of wolf den site characteristics in the Brooks Range of Alaska and potential effects of human disturbance at den sites are discussed. Incidents of wolf-human interactions and factors important in determining wolf responses to humans are noted. It is suggested that in areas where wolves are shy of humans, prolonged human presence within 3.2 km of dens may affect wolf behavior and cause den abandonment (Boyle and Samson 1983).

499. Stevens, D. R. BIGHORN SHEEP MANAGEMENT IN ROCKY MOUNTAIN NATIONAL PARK. Proc. Bienn. Conf. North Am. Wild Sheep Goat Counc., 3. 1982.
One objective of bighorn sheep management in Rocky Mountain National Park, Colorado, has been to reduce the effects of park visitors on sheep. Visitor use of critical sheep habitats has been reduced by trail closures, and initial analysis indicates that disturbance of sheep has been reduced (Boyle and Samson 1983).

500. Stockwell, C. A., G. C. Bateman, and J. Berger. CONFLICTS IN NATIONAL PARKS: A CASE STUDY OF HELICOPTERS AND BIGHORN SHEEP TIME BUDGETS AT GRAND CANYON. Biological Conservation 56:317-328.
Note: new.
Frequent alerting affected food intake.

501. Storer, B. E. *ASPECTS OF THE BREEDING ECOLOGY OF THE PIGMY NUTHATCH AND THE FORAGING ECOLOGY OF WINTERING MIXED-SPECIES FLOCKS IN WESTERN MONTANA. M.S. thesis; Univ, Montana, Missoula. 1977.

502. Strickland, M. A.; C. A. Douglas; M. Novak; and N. P. Hunziger. *FISHER. Pages 586-598 in: J. A. Chapman and G. A. Feldhamer, eds. Wild mammals of North America: biology, management, and economics. John Hopkins Univ., Baltimore. 1982.

503. Strickland, M. A.; C. W. Douglas; M. Novak; and N. P. Hunziger. *MARTEN (MARTES AMERICANA). Pages 599-612 in: Wild mammals of North America: biology, management, and economics. The John Hopkins Univ. Press, Baltimore. 1982.

504. Sweeney, J. M. and J. R. Sweeney. SNOW DEPTHS INFLUENCING WINTER MOVEMENTS OF ELK. Jour. of Mammalogy 65(3):524-526. 1984.
Note: new.

505. Swenson, J. E. ECOLOGY OF THE BALD EAGLE AND OSPREY IN YELLOWSTONE NATIONAL PARK. M.S. thesis; Montana State University, Bozeman. 146 pp. 1975.
Relationships of bald eagles and ospreys to human disturbances were examined during studies in Yellowstone National Park. Ospreys nesting on Yellowstone Lake had significantly lower nest success and productivity per occupied nest than ospreys nesting along streams, and the difference appeared to be related to human disturbance. Bald eagle reproduction did not appear to be affected by human disturbance. Management recommendations are presented (Boyle and Samson 1983).

506. Swenson, J. E. FACTORS AFFECTING STATUS AND REPRODUCTION OF OSPREYS IN YELLOWSTONE NATIONAL PARK. J. Wildl. Manage.; 43:595-601. 1979.
Reproduction of ospreys in Yellowstone National Park was higher along streams with little human disturbance than on Yellowstone Lake, where humans were more concentrated. Reproduction at active nests more than 1 km from a backcountry campsite on Yellowstone Lake was comparable to that for nests near streams. Since undisturbed ospreys reproduced at a rate allowing population stability, the elimination of disturbance by visitor management should allow the declining lake population to stabilize (Boyle and Samson 1983).

507. Swenson, J. E.; K. L. Alt; and R. L. Eng. *THE ECOLOGY OF THE BALD EAGLE IN THE GREATER YELLOWSTONE ECOSYSTEM. Wildl. Monogr. 95. 46 pp. 1986.

508. Taylor, C. R., N. C. Heglund, and G. M. Maloiy. ENERGETICS AND MECHANICS OF TERRESTRIAL LOCOMOTION. Jour. Exp. Biol. 97:1-21. 1982.
Note: new.

509. Telfer, E. S. and J. P. Kelsall. STUDIES OF MORPHOLOGICAL PARAMETERS AFFECTING UNGULATE LOCOMOTION IN SNOW. Can. Jour. Zool. 57:2153-2159. 1982.
Note: new.

510. Temple, S. A. *SYSTEMATICS AND EVOLUTION OF THE NORTH AMERICAN MERLINS. Auk; 89:325-338. 1972.

511. Tennessee State University, Memphis. EFFECTS OF NOISE ON WILDLIFE AND OTHER ANIMALS. U.S. Govt. Printing Ofc., Washington, D.C. 74 pp. 1971.
Note: new.
Prepared for U.S. Ofc. of Noise Abatement and Control.

512. Tenpas, G. H. EFFECTS OF SNOWMOBILE TRAFFIC ON NON-FOREST VEGETATION. Lake Superior Biological Conference, Ashland, Wisc. 1972.
Note: new.

513. Theil, R. P. RELATIONSHIP BETWEEN ROAD DENSITIES AND WOLF HABITAT SUITABILITY IN WISCONSIN. Am. Midl. Nat.; 113:404-407. 1985.
Data on demise of wolf and increase in road densities compared between 1926 and 1960. Wolves failed to survive when road densities exceeded 0.93 miles/sq. mi.

514. Thelander, C. G. SPECIAL WILDLIFE INVESTIGATIONS: BALD EAGLE REPRODUCTION IN CALIFORNIA, 1972-1973. Calif. Dept. Fish Game Project W-054-R-06/WP02/J05/8A. 18 pp. 1973.
Human disturbances interfere with nest selection and occupancy of bald eagles in California, posing a major threat to the already endangered population. A territory in a recreation area used by boaters, campers, and off-road vehicles was abandoned by eagles in 1972, possibly due to human disturbance (Boyle and Samson 1983).

515. Thomas, J. W., ed. WILDLIFE HABITATS IN MANAGED FORESTS IN THE BLUE MOUNTAINS OF OREGON AND WASHINGTON. USDA Forest Service Handbook 553. 512 pp. 1979.
Note: new.
A most comprehensive study of deer and elk management. Provides tools for identifying cover and vegetation types. Quantifies impacts from management activities, including roads.

516. Thompson, R. W. POPULATION DYNAMICS, HABITAT UTILIZATION, RECREATIONAL IMPACTS AND TRAPPING OF INTRODUCED ROCKY MOUNTAIN GOATS IN THE EAGLE'S NEST WILDERNESS AREA, COLORADO. Proc. Bienn. Symp. North. Wild Sheep Counc.; 2:459-464. 1980.
Recreation impacts on mountain goats was assessed by simulating disturbances and observing goat-human interactions in Colorado. Flight distance of goats was greatest for nanny and sub-adult groups, and averaged 82.6 m for all groups. The typical flight intensity was a slow walk away from the human. It is concluded that recreational impacts on the goat population are slight (Boyle and Sampson 1983).

517. Thorne, T.; G. Butler; T. Varcalli; K. Becker; and S. Hayden-Wing. THE STATUS, MORTALITY, AND RESPONSE TO MANAGEMENT OF THE BIGHORN SHEEP OF WHISKEY MOUNTAIN. Wyo. Game Fish Dept., Game Fish Res. Lab. Wildl. Tech. Rep. 7. 213 pp. 1979.
Ecological aspects of bighorn sheep studied in Wyoming included responses of sheep to encounters with humans. Sheep responses to humans varied with sex, age, and activity of sheep, environmental factors, and the nature of the disturbance. All mountain recreationists may stress sheep they encounter; stress induced by such passive harassment might be the most serious consequence of man-sheep encounters. Management recommendations include control of human-sheep interactions (Boyle and Samson 1983).

518. Thorne, E. T., R. E. Dean, and W. G. Hepworth. NUTRITION DURING GESTATIONN IN RELATION TO SUCCESSFUL REPRODUCTION IN ELK. J. Wildl. Manage. 40:330-335. 1976.
Note: new.

519. Thurber, J. M.; R. O. Peterson; T. D. Drummer; and S. A. Thomasma. GRAY WOLF RESPONSE TO REFUGE BOUNDARIES AND ROADS IN ALASKA. Wildl. Soc. Bull.; 22:61-68. 1994.
The response of gray wolves to different road types and human presence at the boundaries of Kenai National Wildlife Refuge, Alaska, was examined in a study of radio-collared wolves in 1976-1979. Wolf activity within discrete distances up to 5 km from roads and boundaries were computed. Wolves avoided oilfield access roads open to public use, yet they were attracted to a gated pipeline access road and secondary gravel roads with limited human use. Wolf response to a major public highway was equivocal, perhaps because wolves used a den only 1 km away. There was no detectable difference in wolf use of land on either side of the eastern refuge boundary adjacent to national forest lands, but on the western, settled boundary wolves used refuge lands more than adjacent private land. The data presented in this study suggests that wolf absence from settled areas and some roads was caused by behavioral avoidance rather than direct attrition resulting from killing of animals.

520. Tibbs, A. L. SUMMER BEHAVIOR OF WHITE-TAILED DEER AND THE EFFECTS OF WEATHER. M.S. thesis; Pennsylvania State University, State College. 93 pp. 1967.
During research of summer behavior of white-tailed deer in Pennsylvania, responses of deer to the presence of the observer and various other disturbances were noted. The observer on a 20-foot high observation tower did not appear to significantly affect deer behavior. Deer response to disturbance was inversely related to its regularity (Boyle and Samson 1983).

521. Titus, J. R.; and L. W. van Druff. RESPONSES OF THE COMMON LOON TO RECREATIONAL PRESSURE IN BOUNDARY WATER CANOE AREA, NORTHEASTERN MINNESOTA. Wildl. Monogr.; 79:3-59. 1981.
Results are reported of a field study to evaluate the impact of outdoor recreationists on nesting and breeding success of the common loon in Minnesota. The authors conclude that that human use of the Boundary Waters Canoe Area slightly reduces the nesting and breeding success of loons in high impact areas, but since some loons are undisturbed and others habituate to human use the adult breeding population has not declined in the past 25 years (Boyle and Samson 1983).

522. Toweill, D. E.; and J. E. Tabor. *THE NORTHERN RIVER OTTER (LUTRA CANADENSIS) (SCHREBER). Pages 688-703 in: J. A. Chapman and G. A. Feldhamer, eds. Wild mammals of North America: biology, management, and economics. John Hopkins Univ. Press, Baltimore. 1982.

523. Tracy, D. M. REACTIONS OF WILDLIFE TO HUMAN ACTIVITY ALONG MOUNT McKINLEY NATIONAL PARK ROAD. M.S. thesis; University of Alaska, Fairbanks. 260 pp. 1977.
Reactions of 5 species of wildlife to human and vehicle activity on the park road in McKinley National Park were studied. Avoidance was observed for some bears, foxes, and possibly caribou; many other animals were attracted to the road. Of the ungulates studied, females with young were the most easily disturbed. Many animals appear habituated to human activities. Management recommendations based on the study are presented (Boyle and Samson 1983).

524. Trimble, S. A. *HABITAT MANAGMENT SERIES FOR UNIQUE OR ENDANGERED SPECIES-MERLIN. USDI, Bur. Land Manage. Tech. Note, Report No. 15, Denver. 41pp. 1975.

525. Tucker, P. ANNOTATED GRAY WOLF BIBLIOGRAPHY. USDI, U.S. Fish Wildl. Serv., Region 6, Denver, CO. 117 pp. 1988.
*Annotated Bibliography.

526. University of Wisconsin, Madison. EFFECTS OF SNOWMOBILE TRAFFIC ON NON-FOREST VEGETATION: SECOND REPORT. College of Agricultural and Life Sciences, Dept. of Agronomy, Univ. of Wisconsin, Madison. 1973.
Note: new.

527. U.S., Fish and Wildlife Service. *GRIZZLY BEAR RECOVERY PLAN. USDI, U.S. Fish Wildl. Ser., Washington, D.C. 199 pp. 1982.

528. U.S. Environmental Protection Agency. EFFECTS OF NOISE ON WILDLIFE AND OTHER ANIMALS. U.S. Environ. Prot. Agency, Off. Noise Abatement. Control NTID300.5. 74 pp. 1971.
Demonstrated and suspected effects of noise on wildlife and domestic animals are reviewed in this comprehensive report. Sources of noise potentially disturbing to wildlife include industries, automobiles, aircraft, and recreational vehicles (Boyle and Samson 1983).
529. U.S. Fish and Wildlife Service. *BALD EAGLE MANAGEMENT GUIDELINES OREGON-WASHINGTON. USDI; Fish and Wildlife Service, Portland Area Office, Oregon. 10pp. 1981.
530. U.S. Fish and Wildlife Service. *NORTHERN ROCKY MOUNTAIN WOLF RECOVERY PLAN. USDI, U.S. Fish Wildl. Ser., Denver. 119 pp. 1987.
531. U.S. Fish and Wildlife Service. *WHOOPING CRANE RECOVERY PLAN. U.S. Fish Wildl. Serv., Albuquerque. 283 pp. 1986.
532. USDI, U.S. Fish and Wildlife Service. GUIDELINES FOR THE MANAGEMENT OF THE AMERICAN WHITE PELICAN, WESTERN POPULATION. U.S. Fish Wildl. Ser. Unpub. ms. 44 pp. 1984.
533. USDI, U.S. National Park Service. PUBLIC USE AND RECREATION; VEHICLES AND TRAFFIC SAFETY. Federal Register 38. Feb. 14, 1973:4405-4407. 1973.
Note: new.
534. USDI, U.S. Fish and Wildlife Service. THE REINTRODUCTION OF GRAY WOLVES TO YELLOWSTONE NATIONAL PARK. U.S. Fish Wildl. Ser., Draft Environmental Impact Statement, Helena, MT. 1993.
535. USDI, U.S. National Park Service. STATEMENT FOR MANAGEMENT-GRAND TETON NATIONAL PARK. U.S. National Park Service. 1985.
536. USDI, U.S. Fish and Wildlife Service. *WHITE-FACED IBIS: MANAGEMENT GUIDELINES, GREAT BASIN POPULATION. U.S. Fish Wildl. Ser., Portland, OR. 31 pp. 1985.
537. USDI, U.S. National Park Service. WINTER USE PLAN ENVIRONMENTAL ASSESSMENT, YELLOWSTONE AND GRAND TETON NANTIONAL PARKS AND JOHN D. ROCKEFELLER, JR., MEMORIAL PARKWAY, WYOMING, IDAHO, AND MONTANA. 114 pp. 1990.
Note: new.
538. VanDyke, F. G., R. H. Brocke, H. G. Shaw, B. B. Ackerman, T. P. Hemker, and F. G. Lindzey. REACTIONS OF MOUNTAIN LIONS TO LOGGING AND HUMAN ACTIVITY. J. Wildl. Manage. 50:95-102. 1986.
Note: new.
539. Vaske, J. J., D. J. Decker, and M. J. Manfredo. HUMAN DIMENSIONS AND WILDLIFE MANAGEMENT: AN INTEGRATED FRAMEWORK FOR COEXISTENCE. In: Wildlife and Recreation: Coexistence Through Management and Research, R. L. Knight and K. J. Gutzwiller, eds., pp. 33-49. Island Press. Washington, D.C. 1995.
Note: new.

540. Vaske, J. J., A. R. Graefe, and F. R. Kuss. RECREATION IMPACTS: A SYNTHESIS OF ECOLOGICAL AND SOCIAL RESEARCH. Trans. North Amer. Wildl. and Nat. Resour. Conf. 48:96-107. 1983.
Note: new.

541. Vermeer, K. SOME ASPECTS OF THE NESTING REQUIREMENTS OF COMMON LOONS IN ALBERTA. Wilson Bull.; 85:429-435. 1973.
A significant correlation was found between number of breeding loons and the amount of human disturbance occurring at lakes. It is suggested that because loons appear to be intolerant of human disturbance they may serve as indicators of the wilderness qualities of lakes (Boyle and Samson 1983).

542. Wagar, J.V.K. RECREATION AND WILDLIFE PROBLEMS OF THE CENTRAL ROCKY MOUNTAINS. J. For.; 52:186-190. 1954.
Recreation based on wildlife resources in the central Rocky Mountains is discussed in terms of noneconomic value to participants. Problems such as value mesuration, financing of research, land ownership, and need for development are discussed (Boyle and Samson 1983).

543. Wall, G.; and C. Wright. THE ENVIRONMENTAL IMPACT OF OUTDOOR RECREATION. Univ. Waterloo, Ontarion, Dept. Geogr. Publ. Ser. 11. 69 pp. 1977.
A comprehensive review of environmental impacts of outdoor recreation is presented, including a chapter on wildlife impacts. Sections describe disturbance of wildlife, loss and gain of habitats, and changes in populations and species composition. The nature and scope of research on wildlife impacts are critically evaluated (Boyle and Samson 1983).

544. Wall, J. H. IMPACTS OF OUTDOOR RECREATION ON THE ENVIRONMENT. Council of Planning Librarians, Monticello, Ill., Exch. Bibliog. 1363. 19 pp. 1977.
Bibliography.

545. Wallace, G. N. VISITOR MANAGEMENT: LESSONS FROM GALAPAGOS NATIONAL PARK. In: Ecotourism: A Guide for Planners and Managers, K. Lindberg and D. E. Hawkins, eds., pp.55-81. The Ecotourism Society. North Bennington, Vermont. 1993.
Note: new.

546. Wallen, R. L. *ANNUAL BROOD SURVEY FOR HARLEQUIN DUCKS IN GRAND TETON NATIONAL PARK. Grand Teton National Park Resource Management files, Moose, WY. 15 pp. 1987.

547. Wallen, R. L. *HABITAT UTILIZATION OF HARLEQUIN DUCKS IN GRAND TETON NATIONAL PARK. M.S. thesis; Montana State University, Bozeman. 67 pp. 1987.

548. Wallen, R. L.; and C. R. Groves. *STATUS AND DISTRIBUTION OF HARLEQUIN DUCKS IN NORTHERN IDAHO. Unpublished Report, Idaho Dept. of Fish and Game, Boise. 34 pp. 1988.

549. Wallis, C. A.; and C. R. Wershler. *STATUS AND BREEDING OF MOUNTAINS PLOVERS IN CANADA. Can. Field-Nat.; 95:133-136. 1981.

550. Walter, H. and K. L. Garrett. EFFECTS OF HUMAN ACTIVITY ON WINTERING BALD EAGLES IN THE BIG BEAR VALLEY, CALIFORNIA. FINAL REPORT. USDA Forest Service, Big Bear District, Fawnskin, Calif. 79 pp. 1981.
Note: new.
Snow machines and ATVs are especially disturbing, probably due to association with random movement, loud noise, and operators are generally exposed.

551. Walter, H. IMPACT OF HUMAN ACTIVITY ON WILDLIFE. Pages 241-262 in: K. A. Hammond, C. Macinko, and W. B. Fairchild, eds. Sourcebook on the environment: A guide to the literature. University of Chicago Press, Chicago, Ill. 1978.
Literature concerning human impacts on wildlife is reviewed. Effects of human population expansion and utilization of energy and resources are emphasized, but nonconsumptive uses are also mentioned. Sections discuss general surveys, attitudes toward wildlife, changes in wildlife population levels, species diversity, and wildlife conservation, among others (Boyle and Samson 1983).

552. Wanek, W. J. and L. H. Schumacher. A CONTINUING STUDY OF THE ECOLOGICAL IMPACT OF SNOWMOBILING IN NORTHERN MINNESOTA. FINAL REPORT FOR 1974-1975. State College, Bemidji, Minn. 1975.
Note: new.

553. Wanek, W. J. ECOLOGICAL IMPACT ON VEGETATION AND SOIL MICROBES. In: Snowmobile and Off the Road Vehicle Research Symposium Proceedings. Recreation Resour., Michigan State Univ. 1973.
Note: new.

554. Wanek, W. J. SNOWMOBILING IMPACT ON VEGETATOIN, TEMPERATURES AND SOIL MICROBES. In: Snowmobile and Off the Road Vehicle Research Symposium Proceedings, pp. 117-130. 1971.
Note: new.

555. Ward, A. L. EFFECTS OF HIGHWAY CONSTRUCTION AND USE ON BIG GAME POPULATIONS. Fed. Highway Ofc. Res. and Dev. Rep. FHWA-RD-76-174. Nat. Tech. Inf. Serv., Springfield, Va. 92 pp. 1976.
Note: new.

556. Ward, A. L. TELEMETERED HEART RATE OF THREE ELK AS AFFECTED BY ACTIVITY AND HUMAN DISTURBANCES. In: Proceedings of Symposium: Dispersed Recreation and Natural Resource Management. Utah State Univ. 1977.
Note: new.
Two cow elk and a spike. Positive correlation to man-caused disturbance and elevated heart rates. Highest incidence occurred with loud noises and direct interaction.

557. Ward, A. L. and J. J. Cupal. TELEMETERED HEART RATE OF THREE ELK AS AFFECTED BY ACTIVITY AND HUMAN DISTURBANCE. Rocky Mt. Forest and Range Exper. Sta., Laramie, Wyo. 1980.
Note: new.

558. Ward, A. L.; J. J. Cupal; A. L. Lea; C. A. Oakley; and R. W. Weeks. ELK BEHAVIOR IN RELATION TO CATTLE GRAZING, FOREST RECREATION, AND TRAFFIC. Proc. N. Am. Wildl. Conf.; 38:327-337. 1973.
Telemetered elk in Wyoming study area preferred to be one-half mile distance from people who were camping, picnicking, and fishing. Suggests that in planning recreation facilities in elk habitat, people concentration areas should be one-half mile from elk feeding sites and provide adequate cover buffer zones (Ream 1980).
559. Warren, H. V. and R. E. Delavault, cited in H. L. Cannon and J. M. Bowles. CONTAMINATION OF VEGETATION BY TETRAETHYL LEAD. Science 137:765-766.
Note: new.
560. Watson, A. BIRD AND MAMMAL NUMBERS IN RELATION TO HUMAN IMPACT AT SKI LIFTS ON SCOTTISH HILLS. Jour. of Applied Ecology 16:753-754. 1979.
Note: new.
561. Weaver, J. L.; R. E. F. Escano; and D. S. Winn. A FRAMEWORK FOR ASSESSING CUMULATIVE EFFECTS ON GRIZZLY BEARS. Trans. N. Am. Wildl. and Nat. Resour. Conf.; 52:364-376. 1987.
562. Webb, R. H.; and H. G. Wilshire. AN ANNOTATED BIBLIOGRAPHY OF THE EFFECTS OF OFF-ROAD VEHICLES ON THE ENVIRONMENT. U.S. Geol. Surv. Open File Rep. 78-149. 15 pp. 1978.
Annotated Bibliography.
563. Weedin, R. NONCONSUMPTIVE USERS: A MYTH. Alaska Conserv. Rev.; 17(3):3,15. 1976.
Several examples of adverse impacts on wildlife from recreationists and scientists are cited to support the contention that nonconsumptive users of wildlife do not exist (Boyle and Samson 1983).
564. Werschkul, D. F.; E. McMahon; and M. Leitschuh. SOME EFFECTS OF HUMAN ACTIVITIES ON THE GREAT BLUE HERON IN OREGON. Wilson Bull.; 88:660-662. 1976.
565. Whelan, T. ed. NATURE TOURISM: MANAGING FOR THE ENVIRONMENT. Island Press, Washington, D.C. 1991.
Note: new.
566. White, P. S. and S. P. Bratton. AFTER PRESERVATION; PHILOSOPHICAL AND PRACTICAL PROBLEMS OF CHANGE. Biol. Conservation 18:241-255. 1980.
Note: new.
It is not only the recreationist who impacts wildlands, but the scientist, educator, and school group as well.
567. White, R. P. *DISTRIBUTION AND HABITAT PREFERENCE OF THE UPLAND SANDPIPER IN WISCONSIN. Amer. Birds; 37:16-22. 1983.
568. Whittaker, J. SNOWMOBILING OVER FORAGE GRASSES. Paper presented at Conference on Snowmobiles and All-terrain Vehicles at Univ. of Western Ontario, Canada. 1971.
Note: new.
569. Wiens, J. A. SPATIAL SCALING IN ECOLOGY. Functional Ecology 3:385-397. 1989.
Note: new.

570. Wilcox, B. A. and D. D. Murphy. CONSERVATION STRATEGY: THE EFFECTS OF FRAGMENTATION ON EXTINCTION. Am. Nat. 125:879-887.
Note: new.

571. Wilinson, T. GREATER YELLOWSTONE NATIONAL FORESTS. Falcon Press, Helena. 104 pp. 1991.

572. Wilkes, B. THE MYTH OF THE NONCONSUMPTIVE USER. Can. Field-Nat.; 91:343-349. 1977.
The concept that some outdoor recreational activities are nonconsumptive of the resource base is examined and rejected. Impacts of such on vegetation, wildlife, and the quality of the environment are noted. User restrictions, a proposed theory for non-use planning, and justification for landscape preservation are discussed (Boyle and Samson 1983).

573. Wilkinson. P. F. ENVIRONMENTAL IMPACT OF OUTDOOR RECREATION AND TOURISM: A BIBLIOGRAPHY. Vance Bibliographies, Monticello, Ill., Publ. Admin. Ser. Bibliogr. P-57. 90 pp. 1978.
*Bibliography.

574. Williams, M. and A. Lester. ANNOTATED BIBLIOGRAPHY OF OHV AND OTHER RECREATIONAL IMPACTS TO WILDLIFE. Eldorado National Forest. USDA Forest Service, Pacific Southwest Region. 10 pp. 1996.
Note: new.

575. Wilmore, S. B. *SWANS OF THE WORLD. Taplinger Publ., New York. 229 pp. 1974.

576. Wilson, D. E. *WOLVERINE. Pages 644-652 in: J. A. Chapman and G. A. Feldhamer, eds. Wild mammals of North America: biology, management, and economics. John Hopkins Univ. Press, Baltimore. 1982.

577. Wilson, L. O. THE FORGOTTEN DESERT BIGHORN HABITAT REQUIREMENT. Trans. Desert Bighorn Counc.; 13:108-113. 1969.
An important but often-neglected habitat requirement of bighorn sheep is space. A review of the literature shows that bighorn are generally intolerant of human disturbance. Management of developments, livestock grazing, other ungulates, and recreational activities should take into account adverse effects of these activities on bighorn sheep (Boyle and Samson 1983).

578. Witmer, G. W. and D. S. deCalesta. EFFECT OF FOREST ROADS ON HABITAT USED BY ROOSEVELT ELK. Northwest Science 59(2):122-124. 1985.
Note: new.
Six females monitored for one year. Human activity on forest roads alters distributions of elk habitat use. Impact may be mitigated by road closures, especially during rutting and calving seasons.

579. Woodworth, C. G.; G. P. Bell; and M. B. Fenton. *OBSERVATIONS ON THE ECHOLOCATION, FEEDING BEHAVIOR AND HABITAT USE OF EUDERMA MACULATUM IN SOUTH CENTRAL BRITISH COLUMBIA. Can. J. Zool.; 59:1099-1102. 1981.

580. Wyoming Game and Fish Department. A STRATEGIC PLAN FOR THE COMPREHENSIVE MANAGEMENT OF WILDLIFE IN WYOMING. Wyoming Game and Fish Department, Cheyenne. 1990.

581. Yalden, D. W.; and P. E. Yalden. THE SENSITIVITY OF BREEDING GOLDEN PLOVERS, PLUVIALIS APRICARIA, TO HUMAN INTRUDERS. Bird Study; 36:49-55. 1989.

582. Yarmoloy, C.; M. Bayer; and V. Geist. BEHAVIOR RESPONSES AND REPRODUCTION OF MULE DEER DOES FOLLOWING EXPERIMENTAL HARASSMENT WITH AN ALL-TERRAIN VEHICLE. Canadian Field-Nat.; 102(3):425-429. 1988.
Five mule deer does were caught by helicopter and net gun and were equipped with radio collars. They were habituated to an all-terrain Vehicle (ATV) travelling the same truck trail for 12 weeks. Three of the females were then followed by ATV for 9 minutes per day for 15 days between 1 to 24 October, 1981, for a total of 135 minutes. The harassed females, but not the other females, shifted feeding into darkness, used cover more frequently, left their home ranges more often, and increased flight distance from the ATV. In the following year the three harassed females collectively raised 1 fawn, having had normal reproduction the year before and the year after. Neither the unmarked females in the study area nor the two radio-collared control females suffered decreases in reproduction during the study. these results confirm expectations and are statistically significant.

583. Young, D.; and J. Beecham. *BLACK BEAR HABITAT USE AT PRIEST LAKE, IDAHO. Pages 73-80 in: Bears: their biology and management. Int. Conf. on Bear Res. and Manage., vol 6. 1983.

584. Young, J. and A. Boyce. RECREATIONAL USES OF SNOW AND ICE IN MICHIGAN AND SOME OF ITS EFFECTS ON WILDLIFE AND PEOPLE. In: Proceedings of the Snow and Ice Symposium. Iowa Coop. Wildl. Res. Unit, Iowa State Univ., Ames. 820 pp. 1971.
Note: new.
Includes skiing.

585. Young, S. P. *THE BOBCAT OF NORTH AMERICA. The Stackpole Co., Harrisburg, PA. 193. 1958.

586. Zarn, M. *HABITAT MANAGEMENT FOR UNIQUE OR ENDANGERED SPECIES-BURROWING OWL. USDI, Bur. Land Manage. Tech. Note T-N-250, Rep. No. 11, Denver. 25 pp. 1974.

ADDENDUM

Anonymous. 1992. News and notes. Yellowstone Science, Yellowstone National Park, Wyo. 21 pp.

———. 1996a. Yellowstone Center for Resources 1995 Annual Report, S. Consolo Murphy, M.A. Franke, and S. Broadbent, eds., Yellowstone Park, Wyo. 82 pp.

———. 1996b. Investigators' Annual Reports for 1995, B. Lindstrom and S. Broadbent, eds., Yellowstone Park, Wyo. 134 pp.

Barnes, V.G., Jr. and O.E. Bray. 1967. Final report: Population characteristics and activities of black bear in Yellowstone National Park. Colo. Coop. Wildl. Research Unit, Colo. State Univ., Fort Collins. 199 pp.

Beall, R.C. 1974. Winter habitat selection and use by a western Montana elk herd. Ph.D. Thesis. Univ. of Montana, Missoula. 197 pp.

Cole, G.F. 1972. Grizzly bear–elk relationships in Yellowstone National Park. J. Wildl. Manage. 36(2):556–570.

DelGuidice, G., F.J. Singer, U.S. Seal, and G. Bowser. 1994. Physiological responses of Yellowstone bison to winter nutritional deprivation. J. Wildl. Manage. 58(1):24–34.

Goodrich, J.M. and J. Berger. 1994. Winter recreation and hibernating black bears (*Ursus americanus)*. Biological Conservation 67:105–110.

Green, G.I. 1988. Dynamics of ungulate carcass availability and use by bears on the northern range and Firehole and Gibbon drainages. Yellowstone Grizzly Bear Investigations: Annual Report of the Interagency Bear Study Team, R.R. Knight, B.M. Blanchard, and M. Mattson, eds., U.S. National Park Service, Bozeman, Mont.

Mattson, D.J. and J. Henry. 1987. Spring grizzly bear use of ungulate carcasses in the Firehole River drainage: Second Year Progress Report. Pp. 63–72 in Yellowstone Grizzly Bear Investigations: Annual Report of the Interagency Study Team 1986. USDI National Park Service. Bozeman, Mont.

Wesley, D.E., K.L. Knox, and J.G. Nagy. 1973. Energy metabolism of pronghorn antelope. J. Wildl. Manage. 57:563–573.

Appendix III

MATRIX OF WINTER RECREATION EFFECTS ON WILDLIFE

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March 1997

Index:

SNOWMOBILING

Bald Eagles

- “Since bald eagles apparently require freedom from human disturbance during the early stages of nesting. . . no habitat alterations, especially campgrounds, campsites or trails, should be made within 1 to 2km of a bald eagles nest” (Swensen 1975:121).

- in Grand Teton National Park, in reference to the RKO bald eagle nesting territory, “at the time of nest initiation there is still ample snow for snowmobiling on the plateau adjacent to the territory. This activity at or above the level of the nest could be inhibiting nest initiation or disrupting incubation during the early stages: (p. 64); recommended that a buffer zone of “1 km or any reasonable distance deemed necessary to minimize any possible disturbance by snowmobiles (p. 80); observed adults in close association with three territories along the Snake River on the earliest eagle observation flight (Feb. 26, 1979) (Harmata 1996).

- in Greater Yellowstone, bald eagles will persist only if there is “adequate habitat available to avoid humans” and management of wintering and migration habitat also should be considered (p. iv); “Eagles shifted their activity patterns to periods when their presence would be least obvious to humans: very early morning and evening” (p. 13); “Snowmachines and all terrain vehicles are especially disturbing, probably due to associated random movement, loud noise and operators are generally exposed . . .” (p. 12); The cumulative effects of many seemingly insignificant or sequential (human) activities may result in disruption of normal behavior of wildlife. “The importance and pertinence to bald eagle behavior cannot be overstated.” (p. 14) (Harmata 1996).

- “Sensitivity of nesting bald eagles to human activity generally diminishes in the following temporal order: nest site selection>nest building>egg laying>incubation>brooding>fledging” (p. 37). This indicates that disturbance in winter may be influential nesting chronology, since nest site selection occurs “year round”, nest building occurs “October through April” and egg-laying occurs “28 February through 10 April” (p. 37) in the Greater Yellowstone area (Harmata 1996).

- in Glacier National Park, the greatest threat to bald eagles was human disturbance; certain areas should be protected from snowmobiling (Shea 1975) (M.S. Thesis).

- in Grand Teton Park, snowmobiling could be inhibiting nest initiation or disrupting incubation at the RKO bald eagle nesting territory and a recommended buffer zone of “1km or any reasonable distance deemed necessary to minimize any possible disturbance by snowmobiles.” During investigators first flight in 1979 on Feb. 26, adult eagles were observed in close association with 3 territories along the Snake River (Alt 1980:80) (M.S. Thesis).

— human disturbance of an avian scavenger guild, includes bald eagles (Skagen et al. 1991).

— in Yellowstone and Grand Teton Parks, bald eagles reside year-round. “Resident bald eagles begin defending territories in late January, display courtship in February, and begin laying eggs and incubating in March. They are sensitive to disturbance by humans from late winter through spring and early summer. Wintering bald eagles depend on three major types of food: waterfowl, carrion, and fish. . . .About 20-40 bald eagles, including 14 nesting pairs spend part of the winter in Yellowstone: (USDI National Park Service 1990:12).

Bears

— a grizzly bear den was abandoned after snowmobile disturbance (Jonkel 1980).

— in Yellowstone Park, black bears began denning between late October and mid-November. The winter dormancy period terminated primarily between late March and the end of April (Barnes and Bray 1967).

— in Yellowstone Park’s Firehole, Madison and Gibbon River drainages, grizzly bears emerged from hibernation and traveled to elk and other native ungulate winter areas between March and early May (Cole 1972).

— in Grand Teton and Yellowstone Parks, “Bears usually emerge from dens in mid-March, but they may emerge earlier depending on elevation, slope, aspect, weather conditions, and the individual bear’s age, sex, condition and behavioral patterns. . .The late winter to early spring period is a crucial feeding time. . .winter-killed carrion. . .is an important source of protein. . .bears. . .must feed undisturbed in preferred areas to meet nutritional requirements. . .Adult females and young grizzlies, especially, need carrion and suffer most from its exclusion for their diet. . .When adult females are excluded on a regular basis from carrion sources, higher mortality and lower fecundity rates can be expected” (USDI National Park Service 1990:15).

Bighorn Sheep

— on winter range, may be debilitating to winter-stressed sheep (Berwick 1968) (M.S. Thesis).

— heart rates of unrestrained bighorn sheep varied inversely with distance from a road, in Alberta (MacArthur et al. 1979).

— cardiac and behavioral responses of bighorn sheep to human disturbance (MacArthur et al. 1982).

Bison

— in Yellowstone Park, snow packed roads used for winter recreation in the interior of the park appeared to be the major influence in major changes in bison numbers and distribution in the park, in the past decade. Roads provided energy-efficient travel that resulted in energy saving within traditional foraging areas, range expansion, major shifts among previously semi-isolated subpopulations, and a mitigation of winterkill and enhancement of calf survival. Effects will ultimately occur on an ecosystem level (Meagher 1993).

— in Yellowstone Park, "Bison were frequently observed traveling in the packed and groomed snowmobile trail and habitually used the trail as part of their intricate network of trails during the winter months" (Aune 1981:34).

Elk

— in Yellowstone Park, resulted in average flight distance of 33.8 m (Aune 1981) (M.S. Thesis).

— in Montana, additional stress from snowmobiles in winter is undesirable (Aasheim 1980).

— in Idaho, road closures allowed elk to remain longer in preferred areas (Irwin and Peek 1979).

— forest roads evoke an avoidance response by elk (Lyon 1983).

— in Rocky Mountain Park, quantified responses of elk to human activities, in winter; non-hunted elk were not significantly affected by on-road visitor activities (Schultz and Bailey 1978).

Mule Deer

— after habituating to an all-terrain vehicle (ATV) for 12 weeks, harassment of radio-collared females by the ATV altered feeding, altered spatial use, and decreased production of young the following year (Yarmaloy 1988).

— elicited motor responses (in sagebrush winter range) when closer than 133m; moved at similar velocities when disturbed by snowmobiles or persons afoot; moved shorter horizontal distance when disturbed by snowmobiles than when disturbed by persons afoot; became more sensitive in moving away from disturbances, as the controlled trials progressed. Test disturbances did not prevent adult females from producing fawns later that year. (See Freddy et al. 1966 in "SNOWSHOEING" section.) (Used 18 radio-collared adult females, Colorado.) (Freddy et al. 1966).

— in Yellowstone Park, resulted in average flight distance of 28.6m (Aune 1981).

— recommended that snowmobiles remain more than 470m from mule deer, in winter, in Colorado (Freddy et al. 1986).

White-tailed Deer

— altered spatial rise, Minnesota (Dorrance 1975).

— increased home-range sizes, Minnesota (Dorrance 1975).

— displaced animals from the vicinity of snowmobile trails, Minnesota (Dorrance 1975).

— routing snowmobile trails away from deer concentration areas was suggested (Eckstein et al. 1979).

— appeared to force deer into less-preferred habitats where nighttime radiant heat loss was increased, Wisconsin (Huff and Savage 1972).

— reduced home-range sizes, Wisconsin (Huff and Savage 1972).

— was detrimental to energy-conserving behavioral adaptations for winter survival, Minnesota (Moen 1978).

— provided trails that deer used, probably reducing energy expenditures, Maine (Richens and Lavigne 1978).

— caused energy expenditures to deer in wintering areas, expenditures calculated, New York (Severinghaus and Tullar 1975).

— effects on distribution in south-central Minnesota (Kopischke 1972).

— snowmobile trails enhanced deer mobility and probably reduced deer energy expenditures; snowmobile disturbance did not cause abandonment of preferred bedding and feeding sites, caused deer responses varying from running out of sight to remaining in place (Lavigne 1976) (M.S. Thesis).

— in responses to snowmobile activity, were more pronounced in a hunted than in an unhunted population of deer (Dorrance et al. 1975).

— established snowmobile trails should be kept at least one-half mile from white-tailed deer wintering areas, in New York (Severinghaus and Tullar 1975).

Trumpeter Swans

— in Yellowstone Park "No future activities should be planned which would increase human use of the north shore of Yellowstone Lake and the Yellowstone River from Fishing Bridge to Alum Creek after 20 October." At the time of her study, up to 100 trumpeters wintered in Yellowstone, although numbers were usually much lower (p. 109); "Land management agencies should direct human activities away from wintering and nesting sites. . .Winter activities such as snowmobiling or cross-country skiing will cause most swans to fly if the person can be seen. Snowmobile and ski trails should be routed away from the river courses" (Shea 1979:111) (M.S. Thesis).

Subnivian Mammals/Small Mammals

— increased mortality in small mammals beneath snow-packed trails; snow compaction by snowmobiles resulted in destruction of air spaces, reduced snow depth, increased snow density and increased thermal conductivity. Also a possibility of toxic air trapped in snow (4% carbon dioxide); destruction of wintering of small mammals at even conservative levels of snowmobile use (mammals trapped in the study: meadow vole, short-tailed shrew, white-footed mouse, ground squirrel and spotted skunk), Minnesota (Jarvinen and Schmid 1971).

— discusses possible effects on small mammals (Aasheim 1980).

— snowmobile compaction of snow changes the physical and thermal properties and potentially affects animals that live beneath the snow in winter (Corbet 1970).

— effects on small mammals (Bury 1978).

— in Minnesota, studied snowmobile use and winter mortality; used traps; meadow vole, short-tailed shrew, white-footed mouse, ground squirrel, masked shrew, spotted skunk, showed increased mortality of small mammals; destroyed subnivian air space, possibly trapped toxic air in snow. Even conservative levels of snowmobiling on trails is destructive to wintering small mammals (Jarvinen and Schmidt 1971; Schmidt 19971, Schmidt 1972).

— snowmobile use affected snowshoe hare and red fox mobility and distribution, in Ontario, mainly within 76 meters of snowmobile trail; hares avoid snowmobile trails, foxes use them (Neumann and Merriam 1973).

— discussed impacts of snowmobiles on the subnivian environment (Pruitt 1971).

Terrestrial Invertebrates

— preliminary studies of snowmobile compaction on invertebrates (Marshall 1972).

Fish

—— ability to swim diminished by snowmobile exhaust (lab and field studies on fingerling brook trout) (Adams 1975).

—— Baldwin, M.F. 1968

—— Bury, R.C. 1978.

—— polluted snow effects on freshwater and aquatic organisms (Hagen and Langeland 1973).

—— effects of snowmobiles on fish resources (Doan 1970).

—— "fish stop swimming in response to ground or sound vibrations" (Gabrielson and Smith 1995:100).

—— detection and reaction of fish to infrasound (Enger et al. 1993).

General

—— a literature review of wildlife harassment by snowmobiles. Documents Congressional testimony on impacts of snowmobiles on wildlife and recommends the prohibition of snowmobiles in national parks (Baldwin and Stoddard 1973).

—— in Ontario, snowmobiles caused significant changes in wildlife behavior; snowshoe hares and red foxes were disturbed mainly within 76 meters of the snowmobile trail; hares avoided snowmobiles trails, foxes used them (Neumann and Merriam 1972).

—— motorized recreational activities are generally much more destructive than nonmotorized activities (p. 194); "the indirect impacts of recreation on wildlife are clearly substantial but even more poorly understood than the direct impacts: (p. 196) (Cole and Landres 1995).

—— lead contamination associated with snowmobile trails (Collins and Snell 1982).

—— contamination of vegetation by tetraethyl lead (Cammon and Bowles 1962).

—— cites snowmobile harassment of ungulates (Curtis 1974).

—— effects on large mammals, medium-sized mammals, small mammals (Bury 1978).

—— effects on fish and wildlife resources (Doan 1970).

— "When people intrude into wildlife habitat, stress on wildlife populations is one result. Snowmobile activity is a particular problem as people move into wintering areas where animals may already be stressed" (Anderson 1995:163).

SNOWSHOEING/HIKING

Bears

— grizzlies do not actively defend dens from humans (Craighead and Craighead 1972).

Bighorn Sheep

— in California, protection of bighorn sheep includes regulation of hiking and sightseeing (DeMarchi 1975).

— in California, hikers did not appear to be adversely affecting sheep on Mount Baxter; if numbers of hikers increase, effects should be monitored (Elder 1977).

— minimizing harassment of sheep should be given top priority among management objectives (Horejisi 1976).

— in Rocky Mountain Park, visitor use of critical bighorn sheep habitats has been reduced by trail closures (Stevens 1982).

— impacts of hiking on Desert Bighorns (Graham 1980).

— in Colorado, hiking influences bighorn sheep distributions and activities (Bear and Jones 1973).

Birds

— see entry for Bald Eagles (Stalmaster and Newman 1978) of this report in section "Stress Induced by Human Activity. . ."

— how close certain passerine bird species will tolerate an approaching human (Cooke 1980).

— in Colorado, in winter, measured flushing responses and distances of American kestrels, merlins, prairie falcons, rough-legged hawks, ferruginous hawks, and golden eagles, when disturbed by humans walking or by vehicles. Walking disturbances resulted in more flushes than vehicle disturbances for all but prairie falcons (Holmes et al. 1983).

Elk

— in Rocky Mountain Park, elk made greater use of areas near roads as the winter-spring study progressed. People approaching animals off-roads usually caused elk to leave open areas; elk exhibited longer flight distances from an approaching person than from an approaching vehicle (Schultz and Bailey 1978).

— in Rocky Mountain Park, snowshoers and hikers occasionally disturbed elk along trails; did not quantify elk reactions; larger herds had greater flight distances (p.36); deep snow, blowing snow, and falling snow were frequently associated with shorter flight distances (p. 45) (Schultz 1975) (M.S. Thesis).

— on Colorado winter ranges, deer and elk avoided areas near roads, particularly areas within 200 meters of roads; deer avoided even dirt roads, some of which were used by hikers (Rost 1975) (M.S. Thesis).

Moose

— in Wyoming, moose were tolerant of close observers when no quick motions or loud noises were made (Denniston 1956).

— in Wyoming, moose moved away when approached on foot within 20-60 feet (Altman 1958).

— in Yellowstone, moose develop considerable tolerance for human disturbance in areas of heavy tourist pressure, but in a control area visitor disturbance caused moose to run and not return to the area until at least the next day (McMillan 1954).

— responses of moose to presence of humans (Corbus 1972).

Mule Deer

— in Colorado, deer were interrupted for longer durations by persons afoot than by snowmobiles; recommended that persons afoot remain more than 334m from mule deer, in winter (Freddy et al. 1986).

SKIING

Bighorn Sheep

— impacts of ski lifts on Desert Bighorns (Graham 1980).

— in California, human disturbance associated with a ski resort; where human use was heavy, Desert Bighorns were forced into poorer habitats (Light 1983).

Elk

— in Yellowstone Park, resulted in average flight distance of 53.5m (Aune 1981) (M.S. Thesis).

— in Yellowstone Park, the median distance at which elk started to move when skiers approached was 400m at Lamar and Stephen's Creek and 15m at Mammoth. Median flight distances moved from disturbance were 42 times greater at Lamar and Stephen's Creek than at Mammoth. No evidence of elk habituation or avoidance was associated with repeated disturbances during the study. At Lamar and Stephen's Creek, elk were displaced from the drainage for at least the duration of human presence and on average returned within 2 days in the absence of human activity. In 5 (of 40) instances, marked elk did not return to the drainages they left when disturbed. Median energy expenditure for movement was 335 Kcal/disturbance (Cassirer et al. 1992) (M.S. Thesis).

— in Elk Island National Park, Alberta, influence of nordic skiers on elk distribution (Ferguson and Keith 1982).

— effects of ski area expansion on elk in mountainous terrain (Morrison 1992) (M.S. Thesis).

Moose

— in Elk Island Park, Alberta, the influence of nordic skiing on moose distribution (Ferguson and Keith 1982).

Mule Deer

— in Yellowstone Park, resulted in average flight distance of 52.4m (Aune 1981) (M.S. Thesis).

Trumpeter Swans

— in Yellowstone Park, "No future activities should be planned which would increase human use of the north shore of Yellowstone Lake and the Yellowstone River from Fishing Bridge to Alum Creek after October 20. Land management agencies should direct human activities away from wintering and nesting sites. . .Winter activities such as snowmobiling or cross-country skiing will cause most swans to fly if the person can be seen. Snowmobile and ski trails should be routed away from river courses" (Shea 1979) (M.S. Thesis).

Wolves and Grizzly Bears

— used GIS to analyze observations of radio-collared wolves and grizzly bears in respect to human activity levels on roads, trails and at ski areas (Purves et al. 1992).

— in Banff, Yoho, and Kootenai Parks, Canada, where winter human use exceeded 10,000 visitors per month, wolves showed aversion to such areas (Purves et al. 1992).

General

— effects of skiing on wildlife in Michigan (Young and Boyce 1971).

ENERGY EXPENDITURES BY WILDLIFE FOR LOCOMOTION

Bighorn Sheep

— prediction of energy expenditures by Rocky Mountain bighorns (Chappel and Hudson 1980).

— energy expenditures resulting from harassment were most damaging when sheep were in poor condition (Geist 1971).

Elk

— in Montana, free-ranging elk herds are generally restricted by snow depths exceeding 46cm (Beall 1974) (Ph.D. Thesis).

— in Montana, activity, heart-rate and associated energy expenditures (Leib 1981) (Ph.D. Thesis).

— energy expenditures for several activities were measured using indirect calorimetry with 5 mule deer and 8 elk; energy expenditures for locomotion in snow increased curvilinearly as a function of snow depth and density. "The additional energy drain on a wintering population on poor range may be an important factor in survival" (Parker et al. 1984:486).

Mule Deer

— see entry for Parker et al. 1984 under "ELK," above.

— in Colorado, when forced from lying to running by persons afoot, increased energy expended from 9 Kcal to 54-127 Kcal; for snowmobiles, this increase was from 2 to 10-25 Kcal (Freddy et al. 1966).

White-tailed Deer

— in New York, snowmobile trails should be kept at least one-half mile from deer concentrations in winter; used energy expenditure calculations to demonstrate danger of snowmobile harassment to winter-stressed deer (Severinghaus and Tullar 1975).

— analysis of deer responses to environmental changes should be on a sequential basis rather than as an overall average; a deer does not respond the same to equally cold weather conditions in November and March. In March, the fat reserve is depleted, females may be carrying fetuses, and requirements for gestation are increasing rapidly (Moen 1976).

— in Maine, deer frequently followed snowmobile trials (Richens and Lavigne 1978).

General

— "While all impacts on animals cannot be documented, it is clear that loss of body reserves has negative effects on the individuals concerned. When combined with other factors such as stressful winters, the animals could die or fail to reproduce. In such cases, populations would decline. When a disturbance occurs over a large region for many years, the population may be unable to continue to reproduce and survive in the area" (Anderson 1995:164).

— running increased the need of ruminants for food (Geist 1971).

— morphological parameters affecting ungulate locomotion in snow (Telfer and Kelsall 1979).

— energetics and mechanics of terrestrial locomotion (Taylor et al. 1981).

STRESS INDUCED BY HUMAN ACTIVITY TO WILDLIFE SPECIES PRESENT IN WINTER IN YELLOWSTONE NATIONAL PARK

Bald Eagles

— human disturbance adversely affected wintering bald eagle distribution and behavior. Distribution patterns were significantly changed, resulting in displacement of eagles to areas of lower human activity, simulated disturbances of persons afoot, in Washington state (Stalmaster and Newman 1978).

— human disturbance is most serious for eagles that depend on large fish or mammal carcasses as their major food source (Anthony et al. 1995).

— human disturbance is an important factor in nest site selection by bald eagles (Murphy 1965).

— modeling cumulative effects of humans on bald eagle habitat (Montopoli and Anderson 1991).

— in Washington state, sensitivity of wintering bald eagles to human disturbance (Russell 1990).

— human disturbance of an avian scavenging guild; includes eagles (Skagen 1980; Skagen et al. 1991).

— human activities had adverse effects on distribution and behavior of wintering bald eagles in Washington state; measured flight distances from simulated human disturbances (Stalmaster and Newman 1978; Stalmaster et al. 1993); high levels of human disturbance during winter could increase energy demands and result in increased mortality rates (Stalmaster and Gessaman 1984).

Bighorn Sheep

— harassment led to increased energy expenditures and was most damaging when animals were in poor condition (Geist 1971).

— at Grand Canyon, studied helicopters and sheep time budgets; frequent alerting affected food intake (Stockwell et al. 1991).

— in Wyoming, all mountain recreationists may stress sheep that they encounter (Thorn et al. 1979).

— harassment has significant impacts on individuals and populations and reduces fitness; passive harassment produces no visible response but may have psychological and physiological effects on sheep (Horejsi 1976).

— in California, human disturbance by recreationists may be limiting sheep populations; measured heart rate responses to harassment (Stemp 1983) (M.S. Thesis).

— cardiac and behavioral responses of bighorn sheep to human disturbance; heart rates varied inversely with distance from road (MacArthur et al. 1982).

— in Rocky Mountain Park, disturbance in critical sheep habitats has been reduced by closure of trails (Stevens 1982).

Black Bears

— assessed the effects of recreational activities on denning ecology of 19 bears for 3 winters in Nevada and California; “data implied that protecting black bear denning areas from human disturbance in winter is important to minimize cub abandonment and needless energetic expenditures by increased winter activity” (Goodrich and Berger 1993).

Canada Geese

— Geese seemed to avoid or leave locations where disturbances restricted feeding (Austin 1988) (Ph.D. Thesis).

Coyotes

— abortion and consumption of fetuses by coyotes following abnormal stress (Gipson 1970).

Elk

— people concentration areas should be one-half mile from elk feeding sites in Wyoming (Ward et al. 1973).

— positive correlation of man-caused disturbance and elevated heart rates in telemetered elk; highest incidence occurred with loud noises and direct interaction (Ward 1977).

— nutrition during gestation in relation to successful reproduction (Thorne et al. 1976).

— in Yellowstone Park, “recurring long periods of limited areas, such as at campsites, appeared to cause limited shifts in elk distribution” (Chester 1976) (M.S. Thesis).

Other Wildlife

— the physiology of alarm in deer mice (Rosenmann and Morrison 1974).

— a 40kg unstressed pronghorn in winter would necessarily consume 900 grams dry matter/day for maintenance and growth. . . 32% higher for animals which were moderately active, and variably increased by cold temperatures (Wesley et al. 1973).

— how close certain passerine birds will tolerate approaching humans (Cooke 1980).

— human disturbance of an avian scavenging guild (Skagen 1988; Skagen et al. 1991).

General

— ecosystem behavior under stress (Rapport et al. 1985).

— "In contrast to sizeable literature of direct effects on wildlife, very few studies have documented impacts resulting from habitat changes induced by recreational activities; . . .the indirect effects of recreation on animal populations are likely to be substantial, but there is little rigorous documentation of these impacts. For invertebrates, amphibians, reptiles, small birds, small mammals, and many fish, these indirect effects are likely to be more substantial than direct impacts of recreationists" (Cole and Landres 1995:192-93).

— snow-based recreation may result in facility construction, fragmenting and reducing the availability of critical habitat; of the snow-based recreational activities, "the impacts of snowmobiling appear to be most pronounced" (Cole and Landres 1995:186).

— "When people intrude into wildlife habitat, stress on populations is one result. Snowmobile activity is a particular problem as people move into wintering areas where animals may already be stressed;. . . animals can be stressed to the point that they require more energy than they can take in, so they must rely on body reserves. Continuous stress from human recreation could eventually cause illness or death of an animal (p. 163); . . ."continuous harassment of animals causes them to expend energy beyond what they can take in during the winter, so some animals can die or fail to reproduce. Stress has been shown to be an important contributor of declining populations in some animals but such population related work is rare" (Anderson 1995:166).

— "From a legal point of view, harassment includes behaviors that indicate an animal has heard a sound, as well as behaviors that indicate aversion;. . .any human-made sound that alters the behavior of animals or interferes with their normal functioning: from a legal point of view constitutes a taking (*e.g.*, Endangered Species Act of 1973; Marine Mammal Protection Act of 1972. (p. 109, Bowles 1993).

— "In polar regions, many animals must rely on stored body reserves and on maintaining low levels of activity to survive winter. Increased human activity in these areas due to increased tourism or industry, for example, will certainly affect their behavior and physiology" (Gabrielson and Smith 1995:104-05).

— at the wildlife community level, "Our understanding of how recreational activities influence communities is just developing. . .;recreationists can directly alter competitive, facilitative, and predator-prey relations, three types of interaction that have the potential to affect community structure and dynamics. Species richness, abundance, and composition in communities can be altered by displacement and through the indirect effects of recreationists on habitat structure. . . Species that are sensitive to the presence of people may be displaced permanently; accordingly, Hammitt and Cole (1987:87) ranked displacement of wildlife as being more detrimental to wildlife than harassment or recreation-induced habitat changes (p. 173). Depending on the species that are lost or the interspecific interactions that are uncoupled by displacement, the presence or abundance of other species may also be affected (Gutzwiller 1995:177).

— nonconsumptive users of wildlife do not exist; gives examples of adverse impacts on wildlife from recreationists and scientists (Weedin 1981).

— the concept that some outdoor recreational activities are nonconsumptive is rejected; includes human impacts on wildlife (Wilkes 1977).

— in national parks, managers must realize that these areas have a finite capacity for absorbing human disturbances such as sightseeing, that may alter energy pathways, disturbing vegetation and wildlife (Houston 1971).

— the physiology of fear and anxiety in man and other animals; physiological and behavioral responses to disturbance; a reference book (Mayes 1979).

— "The adaptive characteristics of wildlife, the recreationists behavior, and the context of the disturbance all seem to be important" (Roggenbuck 1992).

— ecosystem behavior under stress (Rapport et al. 1985).

— trends expected in stressed ecosystems (Odum 1985).

— discussed environmental effects of off-road vehicles, particularly snowmobiles. "Clearly the effective way to protect fish and wildlife is not by restricting hunting or harassment alone, but by banning these vehicles from important habitats" (p. 25); harassment caused an unusual number of abortions in wild animals (Baldwin 1970).

— in Yellowstone Park, elk, bison, coyote, mule deer, and moose in that order, were the most frequently encountered wildlife. Wildlife developed crepuscular activity patterns, some displacement from areas adjacent to trails occurred, movement across trails was inhibited by traffic and by the berm created by plowing and grooming operations. Harassment of wildlife by snowmobilers and skiers increased energy expenditure by wildlife. Effects of winter recreationists on the physical environment included minor air and snow pollution by snowmobile exhaust, litter, noise pollution, and limited physical damage to soils and plants. Study area was portions of Madison, Firehole, and Gibbon River valleys (Aune 1981) (M.S. Thesis).

ROADS

Bald Eagles

— in Washington state, wintering eagles initially used areas isolated from a road and receiving little human use, and only when food became less available in these areas eagles utilized areas having more human activity (Serveen 1975) (M.S. Thesis).

Bears

— in Mt. McKinley Park, some bears were attracted to the park road (Tracy 1977) (M.S. Thesis).

— in Yellowstone Park, bears appear to avoid carrion near occupied roads; there has been some springtime avoidance by emerging bears of the area (and available carrion) within 3 miles of the Old Faithful developed area and within 0.25 miles of active roads in the Firehole and Gibbon valleys. (Bear species not specified). (USDI National Park Service 1990:64).

— in Banff, Yoho and Kootenai Parks, the GIS system was used to analyze locations of radio-collared grizzly bears with respect to roads, trails, and ski areas. Carnivore migration corridors must be preserved or widespread habitat alienation can occur (Purves et al. 1992).

— in Yellowstone, in 1995, 6 black bears were known to have been hit by vehicles, one of which is known to have died; no grizzlies were known to have been hit by vehicles (Anon. 1996).

Bighorn Sheep

— in Alberta, heart rates of bighorns varied inversely with distance from road (MacArthur et al. 1979).

— in Rocky Mountain Park, trail closures have reduced visitor use of critical sheep habitats, reducing disturbance of sheep (Stevens 1982).

— in Alaska, bighorn sheep that occupy ranges away from the Denali Park Road must cross the road during seasonal migrations, but have not habituated to traffic even though the road has been there for 54 years (Dalle-Molle and Van Horn 1991).

Bison

— in Yellowstone and Grand Teton Parks "Bison. . .travel on groomed and plowed roads" (USDI, National Park Service 1990:62).

Deer

— on winter ranges in Colorado, deer avoided areas near roads, particularly within 200 meters of roads (Rost 1975) (M.S. Thesis).

— in Washington state, deer showed a general reduction of use up to 1/8 mile from roads, depending on amount of roadside cover; deer were substantially affected in meadows where roadside cover was lacking (Perry and Overly 1976).

— quantified impacts on deer of management activities including roads (Thomas 1979).

Elk

— on winter ranges in Colorado, elk avoided areas near roads, particularly within 200 meters of roads (Rost 1975) (M.S. Thesis).

— construction of roads in elk habitat effectively eliminated prime area from elk production (Pederson 1979).

— in Idaho, road closures allowed elk to remain longer in preferred areas (Irwin and Peek 1979).

— in Glacier Park, habituation to roads made elk more vulnerable to poaching (Singer 1975).

— in Yellowstone Park ". . .elk . . .travel on groomed and plowed roads" (USDI, National Park Service 1990:62).

— human activity on forest roads alters distributions of Roosevelt elk activity; monitored 6 cows for one year (Witmer and deCalesta 1985).

Foxes

— in Mt. McKinley Park, some foxes were attracted to the park road (Tracy 1977) (M.S. Thesis).

Moose

— in Yellowstone and Grand Teton Parks, "moose travel on groomed and plowed roads" (USDI, National Park Service 1990:62).

Mountain Lions

— in Arizona and Utah, lions selected home areas with lower road densities (Van Dyke et al. 1986).

Wolves

- on Isle Royal, wolves avoid contact with humans; management suggestions include limiting visitation, no further trail development and discouragement of winter visitor use (Peterson 1977).

- in Banff, Yoho, and Kootenai Parks, the GIS system was used to analyze locations of radio-collared wolves with respect to roads, trails, and ski areas. Wolves showed aversion to areas where human use exceeded 10,000 visitors per month (Purves et al. 1992).

- in Jasper Park, wolves tend to avoid traveled roads (Carbyn 1974).

- describes interrelationships of wolves, prey, and man in Alaska (Gasoway et al. 1983).

- in Kenai NWR, Alaska, radio-collared wolves avoided roads open to the public but used other roads with limited human use; management plans for wolves may include reduction of roads and seasonal or permanent gating of roads to reduce human access (Thurber et al. 1994).

General

- in Mt. McKinley Park, among ungulates, "females with young were the most easily disturbed by human activity on the park road" (Tracy 1977) (M.S. Thesis).

- when trails are developed, "discarded human food wastes provide different sources of food for animals, affecting their population structure"(Anderson 1995 citing Knight and Cole 1991).

THERMAL AREAS

Bald Eagles

- in Grand Teton and Yellowstone Parks, "a relationship seems to exist between open water and nest site selection. . .Thus 87% of the nesting territories were located either in major rivers, or lakes within 5 km of their inlets or outlets, or <u>along streams or lakes in thermal areas</u>" (Alt 1980:40) (M.S. Thesis). (emphasis added).

- in the Greater Yellowstone Ecosystem, the primary wintering areas are along major rivers, usually near concentrations of wintering ungulates and open water where waterfowl and fish are available. Thus, food availability appears to determine bald eagle use of an area during winter (p. 38). <u>Thermal areas</u> keep some waters open in Hayden and Pelican Valleys and small portions of Lewis and Heart Lakes, which give bald eagles access to wintering waterfowl and fish (Swensen et al. 1986) (emphasis added).

— in Yellowstone, in winter, "Eagle activity is greater along streams that remain ice-free and in thermal-influenced areas. . ." (USDI National Park Service 1990:12) (emphasis added).

— in Yellowstone, there are 19 active territories and eagles "can be seen year round in the park, nesting usually in riparian zones along the Madison and Yellowstone rivers where raptors can find fish at any time of year in thermally influenced open waters (p. 5) . . .eagles also scavenge on the carcasses of winterkilled elk and bison, particularly on the northern range and in the Firehole Valley" (Anon. 1995:6) (emphasis added).

Bison

— in Yellowstone Park, "The survival factor, for bison in parts of Yellowstone, may be the existence of thermal areas. As previously discusses, thermally active areas do not attract large numbers of bison for the winter, but the use of certain areas for brief periods, particularly at times of prolonged cold combined with heavy snow depth, as observed by Jim Stradley, or in late winter as seen during the study period may determine the lower limit to which the population numbers drop. . .where winters are more severe, those valleys which have bison have either extensive thermal or warm areas, or else many small ones among which movement is possible. Some streams which remain unfrozen because of an influx of warm water are an additional feature of most wintering areas. . ." (Meagher 1970) (Ph.D. Dissertation) (emphasis added).

— "Total use by bison of all areas where thermal influences alleviated otherwise more severe winter conditions was more than the use of thermally active sites. In the three valleys of Hayden, Pelican and the Firehole the amount of bison use made of sedge bottoms with lessened snow depths, and the ice-free streams indicated that thermal influence was important in maintaining wintering populations (p. 100) (Meagher 1970) (Ph.D. Dissertation) (emphasis added).

Elk

— in Yellowstone, elk habitat along the Madison, Firehole and Gibbon rivers has deeper snow than the northern range; consequently thermal areas with snow-free vegetation or shallow snow are very important to winter habitat for elk (USDI National Park Service 1990:10).

Trumpeter Swans

— in Yellowstone Park, "Snowmobile and ski trails should be routed away from river courses" (Shea 1979) (M.S. Thesis).

— in Yellowstone, "Trumpeter swans remain in the area year-around and are joined by winter migrants. About nine pairs nest in Yellowstone, and in winter the population increases to somewhere between 40 and 300, depending on the number of migrants spending at least part of the year there. . .The slow flowing open water habitat required for swan survival is increased by thermal activity, but even in Yellowstone it becomes scarce during the coldest part of the winter: (USDI National Park Service 1990:16). (emphasis added).

General

— in discussing indirect effects of recreation on wildlife, "The vulnerability and variety of the habitat, and its importance to wildlife, should also be considered" (Cole and Landres 1995:183). (emphasis added).

— "In the long term, if extensive habitat alteration occurs for animals that have a limited distribution, the population of a particular species may experience substantial declines" (Anderson 1995:157).

ENERGETICS AND NUTRITION OF WILDLIFE IN WINTER

Bears

— in Yellowstone, available food for grizzly bears . . .is the greatest threat to survival of the bear population; increasing recreational activities in the Yellowstone area will increase this problem (Knight et al. 1988).

— grizzlies commonly scavenged in dead elk; total elk mortality in study area of Firehole, Madison and Gibbon River drainages in winter-spring 1969-70, was 268 elk; in Yellowstone Park's Firehole, Madison and Gibbon River drainages, grizzly bears culled elk with low energy reserves (Cole 1972).

Bighorn Sheep

— prediction of energy expenditures by bighorn sheep (Chappel and Hudson 1980).

Bison

— in Yellowstone Park, bison "Use of the plowed road for relatively easy and energy-efficient travel probably facilitated learning and a rapid increase in numbers" (Meagher 1989:674). Author here was referring to the plowed road between Tower and Mammoth, where daily road plowing began in the late 1940s.

— in Yellowstone Park, in Hayden, Pelican and Firehole Valleys ". . .thermal influence was important in maintaining wintering populations" of bison (p. 100), sites of thermal influence "were of great importance to the bison population during brief but critical periods" (p. 100). "In spite of limited use, these areas probably represent the margin of survival of the herd groups in Firehole, Hayden, and Pelican Valleys during the most extreme winter conditions" (p. 101). "The survival factor, for bison in parts of Yellowstone, may be the existence of thermal areas" (p. 111), and ". . .thermally active areas do not attract large numbers of bison for the winter, but the use of certain areas for brief periods, particularly at times of prolonged cold combined with heavy snow depth. . . or in late winter. . . may determine the lower limit to which population numbers drop" (p. 112) (Meagher 1970) (Ph.D. Dissertation).

— in Yellowstone Park, winter weather is a population regulating influence on bison (Meagher 1976).

— in Yellowstone Park's Madison-Firehole range, in winter, progressive nutritional restriction in bison was greater than on the northern range or in Pelican Valley (DelGuidice et al. 1994).

Elk

— in Yellowstone Park, assessed nutritional deprivation of cow elk groups on northern range and Madison-Firehole range and estimated elk density and calf:cow ratios. Found significant declines in calf:cow ratios from early to late winter were associated with nutritional deprivation, particularly in areas of high elk density and/or deep snow (DelGuidice et al. 1991).

— passive harassment of elk resulting from human activities caused overgrazing of marginal habitats, which may be especially harmful to elk during severe winters when their energy budgets are stressed (Morganti and Hudson 1980).

— telemetered heart rates of elk affected by human disturbance (Ward and Copal 1980).

— effects of nutrition during gestation in relation to successful parturition in elk (Thorne et al. 1976).

Moose

— seasonal energy expenditures and thermoregulatory responses of moose (Renecker and Hudson 1986).

— the metabolic rate of moose during winter (November to March) was similar to values reported for other wild ungulates; tame moose; Alaska (Regelin et al. 1985).

Mule Deer

— urine cortisol measurement in winter provide a tool for assessing population condition in mule deer (Saltz and White 1991).

White-tailed Deer

— lowest ecological metabolism in white-tailed deer occurs in winter; an adaptation for energy conservation. Resource needs lower when range resources are reduced. The timing of spring arrival is important to population dynamics, with effect pronounced 2 years later when fawns become breeders (Moen 1978).

General

— "During winter, processes influencing energy intake, rather than energy expenditure, have a much greater impact on energy balance of ungulates (Hobbs 1989), suggesting that disruption of wildlife while feeding is of greater concern than causing wildlife to flee. Mammals show a weaker response to humans during the winter months than at other times of the year. Hamr (1988) reported that chamois were least sensitive to recreationists when snow was deep, forage was inaccessible, and energy conservation was decisive to survival" (Knight and Cole 19959:73-74).

— discusses maintenance metabolism in herbivores (book) (Hudson and Christoperson 1986).

— the energetic cost of cratering (digging) through uncrusted snow (by caribou) was 118 Joules/stroke, whereas that cost was 481 Joules/stroke when cratering through snow compacted by a snowmobile (Fancy and White 1985).

NOISE

Birds

— seem to habituate more rapidly to mechanical noise than to human presence (Gabrielsen and Smith 1995:104).

Deer

— seem to be considerably more tolerant of noise than deer are (Bury 1978).

Elk

— seem to be considerably less tolerant of noise than deer are (Bury 1978).

Fish

— detection and reaction of fish to infrasound (Enger et al. 1993).

Mice

— effects on blood eosinophil levels and adrenals of mice (Anthony and Ackerman 1995).

General

— effects of snowmobile noise on large game animals appear to vary by species (Bury 1978).

— data for domestic and laboratory animals were extrapolated for wildlife; potential effects included masking of signals and calls; chronic exposure could result in physiological and behavioral changes; effects would most likely be cumulative (Dufour 1971).

— hearing in vertebrates, a psychophysics data book (Fay 1988).

— effects of noise on wildlife; quantifying the acoustic dose when determining the effects of noise on wildlife; a perspective of government and public policy regarding noise and animals (a book) (Fletcher and Busnel 1978).

— mammals habituate more rapidly to mechanical noise than to human presence (Gabrielsen and Smith 1995:104).

— noise effects on wildlife (Tennessee State Univ. 1971).

— presents an animal response model to quantify effects of noise on wildlife (Janssen 1978).

— a method for measuring wildlife noise exposure in the field (Kugler and Barber 1993).

— effects of noise on wildlife and other animals; sources potentially disturbing to wildlife include recreational vehicles (U.S. Environ. Protection Agency 1971).

— effects on wildlife (Bollinger et al. 1973).

— reviews recreational noise influences on wildlife, including snowmobiles; “. . .noisy vehicles will affect them at much greater ranges than humans. However, if they are habituated to vehicle noise at levels that are not aversive, humans laughing and yelling can arouse responses at greater ranges than snowmobiles (p. 113). With repeated exposure, all vertebrates habituate or adapt behaviorally and physiologically. . .One form of adaptation is sensitization (an increase in responsiveness) resulting from negative experiences associated with noise; vertebrates from fish to mammals can learn to avoid noise associated with danger. . .Motivations such as hunger that keep animals from paying attention to noise lessen its aversiveness. . .Guidelines that protect human hearing apply to many terrestrial mammals because they are based on studies of laboratory animals (p. 115). Noise can doubtless affect communication and sleep in animals. Noise is suspected of causing stress-related illness in both humans and animals. . .Wild animals can abandon favored habitat in response to disturbances or incur energetic expenses after reacting. . .Masking and hearing loss represent a life-threatening hazard in predator-prey interactions. . .noise might cause animals to become irritable, affecting feed intake, social interactions, or parenting. All these effects might eventually result in population declines. Even if populations were unaffected, genetically determined differences in susceptibility might exert subtle selection that eventually could affect fitness." Each of these potential effects is considered in detail (p. 116) (Bowles 1995).

WILDLIFE HABITAT CORRIDORS

— importance of migration between fragments of nature reserves (Burkey 1989).

— habitat patch connectivity and population survival (Fahrig and Merriam 1985).

— the need for movement corridors (Harris and Gallagher 1989).

— dispersal and connectivity in metapopulations (Hansson 1991).

— ecological considerations in the design of wildlife corridors (Lindenmayer and Nix 1993).

— consequences and costs of wildlife corridors (Simberloff and Cox 1987).

— effects of habitat fragmentation on extinction (Wilcox and Murphy 1985).

— for cougars (Beir 1993).

— in Colorado, <u>mule deer</u> migration was strongly correlated to winter severity; demonstrated strong fidelity to winter ranges; fidelity to individual movement patterns is long range, possibly for life (Garrott et al. 1987).

— carnivore habitat corridors must be preserved or widespread habitat alienation can occur for <u>wolves</u> and <u>grizzlies</u> in Yoho, Kootenai and Banff National Parks (Purves et al. 1993).

POLLUTED SNOW

— polluted snow in southern Norway, in winter (Elgmark and Langeland 1973).

- polluted snow effects on freshwater and aquatic organisms (Hagen and Langeland 1973).

- lead emissions from snowmobiles as a factor in lead contamination of snow (Ferrin and Coltharp 1974).

- snowmobile engine emissions and their impact (Hare and Springer 1974).

- in Minnesota, a study of small mammals indicated that snowmobile use may trap toxic air in snow (Jarvinen and Schmidt 1971). (Also see "Snomobiling - Subnivian Mammals/ Small Mammals" section of this report).

- "Pollutants produced by recreational activities (*e.g.*, gasoline and oil leaked by off-road vehicles) or sewage effluent may take considerable time to flow into groundwater or be flushed from the soil surface to streams or lakes" (Cole and Landres 1995:191).

- contamination of vegetation by tetraethyl lead (Cannon and Bowles 1988).

APPENDIX II. POTENTIAL OPPORTUNITY AREAS

Potential Opportunity Areas (POA) are lands in the Greater Yellowstone Area that possess the physical and social conditions desired by various winter recreationists. POAs describe an area's recreation potential, not necessarily its existing condition. The experiences range from those that are easily accessible and highly developed (such as snowmobiling to Old Faithful) to those that are considered remote backcountry experiences (such as skiing in the Absaroka-Beartooth Wilderness). These areas are mapped in *Winter Visitor Use Management: A Multi-agency Assessment, Final Report of Information for Coordinating Winter Recreational Use in the Greater Yellowstone Area*, Greater Yellowstone Coordinating Committee, 1999.

Each of the descriptions below includes some of the most important attributes that the opportunity area should possess, setting it apart from the others. Though the names of the opportunity areas are primarily reflective of snowmobile and ski activities, other recreation uses such as ice climbing, trapping, hunting, ice fishing, photography, dog sledding, using snowplanes, and four-wheel driving could be appropriate in various opportunity areas. The activities that could be accommodated in each area depends on the mutual compatibility of the activities and the social and environmental conditions necessary to support quality recreational experiences, while protecting wildlife and other resources. For example, in many "groomed motorized routes" (Opportunity Area 4), cross-country skiing and other nonmotorized activities could occur. In "groomed nonmotorized routes" (Opportunity Area 7), many different activities could occur, but motorized activities would not be compatible.

Comparative use levels are described for each opportunity area. For example, the use level considered consistent with "groomed motorized routes" (Opportunity Area 4) is described as "high" while the use level for "motorized routes" (Opportunity Area 5) is described as "moderate." More detailed analysis, beyond the scope of this assessment, will be required to quantify the actual numbers that constitute "high" or "moderate" use. Existing use levels vary widely in different areas that might be allocated to the same opportunity area classification. The team emphasizes that the described use levels represent the *upper limits* that resource managers believe are compatible with quality recreational experiences. It is neither expected nor desired that all areas reach the upper use limits.

1. DESTINATION AREAS

These are highly developed, highly used hubs of concentrated recreational use on public lands or lands under permit by public agencies. Located on travel routes, these areas provide support services for a wide variety of activities and may include lodging, food services, instruction, and interpretation. Destination areas may be staging and access points for recreational activities serving a fairly large surrounding area. Multiple uses are expected to occur, and some use conflicts are tolerated as are some resource impacts. (This analysis does not include towns, cities, and communities; they appear on the base map for reference purposes only.)

2. PRIMARY TRANSPORTATION ROUTES

These are highways open year-round and used for commercial as well as recreational traffic. Primary transportation routes have a recreational component, such as accessing trailheads and winter use destination areas, but are primarily travel corridors.

3. SCENIC DRIVING ROUTES

Forest and park visitors use these roads primarily to enjoy the surrounding area scenery, to access trailheads, and to access winter use destination areas. The roads are open all year to wheeled vehicles, but generally carry less traffic than the primary transportation routes. Because viewing scenery and wildlife, and enjoying the drive are the primary experience for many users, visual quality and clean air are important. Some sound associated with highway travel is tolerated.

4. GROOMED MOTORIZED ROUTES

Along these routes, motorized and nonmotorized activities occur in safe, highly maintained corridors and traverse a variety of settings. Destinations and attractions along the way are of high interest. Appropriate developments could include restrooms, warming huts, food services, interpretive facilities, gas stations, and other conveniences. Terrain on the groomed surface is gentle and suitable for novices. Smooth, groomed snow surfaces are important. High use levels are expected, and relatively more sound is tolerated than in the other opportunity areas.

5. MOTORIZED ROUTES

Generally routes are well-marked and relatively safe corridors for motorized and nonmotorized activities. Included in this opportunity class are moderate- to high-density snow play areas. Facilities are usually limited to those located at trailheads. Some of these routes may be distant from access points and roads, but these are not places where one is likely to get lost. Greater skill levels are required here than on groomed routes because snow surfaces are not expected to be as smooth. Varied terrain is desirable for moderately challenging experiences. Moderate use levels are expected, and while some snow machine sound is tolerated, it is generally expected to be more intermittent than the relatively constant sound along the groomed routes. These routes may be groomed but not to the standards of POA 4.

6. BACKCOUNTRY MOTORIZED AREAS

These combine marked but ungroomed motorized routes and low- to moderate-density snowmachine play areas. Challenge and adventure are important. Little in the way of support facilities, other than parking at access areas, is needed. Use levels are low to moderate. Moderate to high levels of remoteness are desirable, as are scenic views, challenging terrain, deep snow, and untracked powder. Intermittent noise is tolerated. Users need experience and skill for a safe outing.

7. GROOMED NONMOTORIZED ROUTES

People come for nonmotorized experiences in safe and often well-maintained corridors. These areas are used as much for exercise and race training as for recreation, but they are suitable for beginners where the terrain is gentle. Nearby support services are desirable and may include restrooms, trailheads, informational and directional signing, instruction, lodging, and warming areas. Fairly high use levels are expected. Sound and visual evidence of other nearby activities and from adjacent opportunity areas are tolerated but not desirable.

8. NONMOTORIZED ROUTES

Park and forest visitors use ungroomed nonmotorized routes to ski or snowshoe in a natural setting on routes that are apparent but not necessarily marked. Developments in these areas are limited to access points and parking. Gentle topography provides interest but not a high level of challenge. Consistent snow is important, but various snow conditions are tolerated. Low to moderate use levels are expected, but a high level of sound is disruptive to the experience. Outings are generally one day or shorter in duration, although rental cabins may be the destination along some routes.

9. BACKCOUNTRY NONMOTORIZED AREAS

These provide backcountry experiences characterized by remoteness and freedom from development and other human traces. Solitude, low use levels, and absence of noise are important elements of this experience. Terrain is varied and provides moderate to high levels of challenge and adventure. Backcountry and route-finding skills are required for a safe outing. Outings may be more than one day in duration.

10. DOWNHILL SLIDING (NONMOTORIZED)

Users of these areas are looking for challenge, adventure, and opportunities to improve skiing and snowboarding skills. While absence of crowds, developments, and regulation are important to this experience, moderate use levels are tolerated. Untracked snow provides the ultimate satisfaction for these users. Quiet is desirable, but some sound from nearby activities may be tolerated. The best areas are close to access points.

11. AREAS OF NO WINTER RECREATIONAL USE

These are areas where administrative closures protect wildlife winter range and other lands not managed for recreation, or where use is prohibited because of sensitive resources, such as thermal features.

12. LOW-SNOW RECREATION AREAS

Low-snow and snow-free conditions during much of the winter characterize these areas. Hiking, fishing, hunting, bird watching, mountain biking, or ATV riding and 4-wheel drive activities if consistent with travel management plans are common activities that could occur. If snow is present motorized activities occur in designated routes consistent with travel management plans. Snow related winter uses are appropriate unless otherwise regulated.